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Contents of This Issue

EDITORIALS 395

FRONTISPIECE—CONOWINGO UNITS NOW ON LINE..... 398

RELATION BETWEEN STEAM AND HYDRO GENERATION... 399
By C. P. Dunn
Too much emphasis placed on competition. Both types of generation have field. Opportunities exist for lowering hydro costs.

AUTOMATIC SUBSTATION INSPECTIONS..... 801
By O. M. Ward

GENERATOR ROTOR ASSEMBLY IMPROVED BY BOLT-STRETCHING DEVICE 801

HEAVY EQUIPMENT HANDLING SIMPLIFIED BY DERRICK TRUCK 802
By D. A. Hord

SIMPLIFIED DISTRIBUTION PLANNING..... 803
By W. R. Bullard
Methods of calculating the economical characteristics of electrical distribution systems, particularly transformer spacing and sizes of line conductor.

BROKEN INSULATORS WITHSTAND NORMAL VOLTAGE.... 806
By R. Rader

USEFUL NOMOGRAM FOR PHOTOMETRIC WORK..... 807
By Hempstead S. Bull

CONSTRUCTION PRACTICES ON FLORIDA-GEORGIA LINES.. 808

TRANSFORMER VAULT RELAY PROTECTION..... 810

UTILITY TRAINING COURSE FOR COLLEGE GRADUATES.... 810

URGES PUBLIC ACQUAINTANCE WITH NEIGHBORHOOD CONTRACTOR 810

THE PURCHASING AGENT SPEAKS..... 811
By Lewis A. Jones
A frank discussion of some of the courses of price cutting in this buyers' market. A bit of background and a few suggestions from the head of the purchasing agents' association.

HIGH-PRESSURE PIPE LINE FABRICATED BY ELECTRIC WELDING 813

BENEFITS OF STANDARD SPECIFICATIONS..... 814
By James D. Winans

FIELDS FOR FLOODLIGHTING..... 816
By A. H. Smith
Night illumination of parks, beaches and athletic fields increases their value to public. Floodlighting of private buildings a profitable investment. Fields of application.

ELECTRICITY CONSUMPTION ON THE FARM..... 821
By Frank D. Paine

BUSINESS ALLOCATION AT CAMBRIDGE, MASS. 821

LETTERS FROM OUR READERS..... 822

DIGEST OF ELECTRICAL LITERATURE..... 823

NEWS OF THE INDUSTRY..... 825
COURT DECISIONS, COMMISSION RULINGS..... 832
NEWS ABOUT MEN OF THE INDUSTRY..... 833
FINANCIAL AND STATISTICAL 835
BUSINESS NEWS AND MARKET CONDITIONS..... 839
NEW EQUIPMENT AVAILABLE..... 843
ELECTRICAL PATENTS 844

BUSINESS FACTS FOR ELECTRICAL MEN..... 845

A Good Word from Australia

"THE annual progress and statistical number of the ELECTRICAL WORLD, published by the McGraw-Hill Company on Jan. 7, presents an astonishing array of graphs, tables and typescript dealing with the operations of the electrical industry in the U. S. A. in 1927 and estimating the outlook for 1928. Only a powerful and wealthy industry could meet the cost of preparing such a mass of valuable data, and probably no other technical publishing organization could undertake the herculean task."—*Electrical Times*, Feb. 27, 1928.

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Electrical World

McGraw-Hill Publishing Company, Inc.
JAMES H. MCGRAW, *President*

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Editor

VOLUME 91 — *New York, Saturday, April 21, 1928* — NUMBER 16

What Is the Significance of the Portland Election?

WHEN at a special election last week the people of Portland, Ore., refused by a two-to-one vote to sanction the sale of the Northwestern Electric Company to its competitor, the Portland Electric Power Company, they indicated a preference to maintain competition in the public utility field rather than accept a guaranteed 10 per cent rate reduction for a period of five years. The proposed consolidation would have meant an aggregate saving to Portland consumers of approximately $3,000,000 during the next ten years. Under the present franchise of the Northwestern company, which has ten years to run, the city of Portland receives a 3 per cent gross earnings tax.

There was little outward opposition to the consolidation, which by virtue of a requirement in the franchise of the Northwestern company had to be sanctioned by the City Council. The Council had expressed its approval of the merger, but officials of the two companies, desiring to have a full expression of public opinion, defrayed the expense of a special election at which no other issue was involved. The returns would seem to indicate that either the people lacked confidence in the companies and the set-up proposed or felt that competition in the public utility field is the surest safeguard to low rates. It was to check the arrogance of the old Portland Railway & Light Company under the late Mr. Josselyn that the city invited the Fleishhackers to start the Northwestern company. This and the fact that telephone rates in Portland were increased following the absorption of a small independent telephone company by the larger company may have had a bearing on the result. The fact remains, however, that 50 per cent of the registered voters of Portland refused to indorse the proposition. That is significant enough to cause the industry in that section to indulge in some introspection.

* * * *

National Authority Must Not Trespass on Domain of Business

PRESIDENT COOLIDGE voiced the above sentiment in an address last Monday night to the Daughters of the American Revolution. He was even more firm in his conviction that the policy of keeping the government out of business was one of the essential declarations of the Revolutionary period. The President has expressed himself in a similar strain on many other occasions, but such is the temper of Congress that the principle cannot be reiterated too often.

"Society requires certain public activities like highways and drainage, which are used in common and can best be provided by the government," he asserted; "but in general the country is best served through competition of private enterprise. If the people are to remain politically free, they must be economically free. Their only hope in that direction is for them to keep their own business in their own hands."

Before Congress at the present time are two major measures of interest to the nation and of chief import to the electric light and power industry—those concerning Muscle Shoals and Boulder Canyon. In both of these cases the government, or rather a minority in Congress, seeks an innovation which is at variance with the established practices of the nation. Not only would these men plunge the government into business; but in the Boulder Canyon measure, for example, they seek to coerce the states. Before the six or seven states involved in this legislation have even ratified a treaty, Congress, whose function in this case should be to confirm the agreement, seeks to initiate a movement which cannot become effective until the states and the Congress itself sign the treaty. All this is contrary to the policy of the administration and to the best traditions of the United States.

The electrical industry should press for a decision on the pending legislation now being debated in Congress in keeping with the principles enunciated by the President. Senator Norris ought not to be able to thwart the will of the people and of the Congress indefinitely, nor should Senator Johnson of California succeed in hoodwinking the nation into pouring millions into that already doubly blessed state at the expense of its neighbors. The rights fought for by the founders and the ideals they set up have proved their worth. To maintain them unshaken is both an ideal and a duty.

* * * *

British Electrical Performance and Its Handicaps

A COMPARISON of the performance of the electric light and power industry of Great Britain with that of the United States is interesting. While the showing is highly complimentary to the utility companies of this country, it is not altogether bad for Great Britain if all the facts are taken into consideration. It does indicate, however, that there is opportunity for great improvement and that the Electricity Commissioners, if adequate powers are granted them, can work wonders in a country possessing abundant fuel, manifold industries and congested population.

The annual analyses and summaries of electricity output in Great Britain for the year ended March 31, 1927, have just been published by the Electricity Commissioners. They show a total output of 8,365,857,198 kilowatt-hours, an increase of less than 3 per cent, from a fuel consumption of 8,856,938 tons, an increase of 4.8 per cent over 1926. The average fuel consumption in-

creased from 2.40 pounds to 2.43 pounds per kilowatt-hour, the best showing having been made by the Barton station of the Manchester Corporation, which on a load factor of 53.2 per cent generated a kilowatt-hour from 1.33 pounds of coal. Of course, heat units rather than pounds of coal would have been a better yardstick; but pounds of coal will suffice. Moreover, the Barton station, because of inadequate condensing water, depends on cooling towers, like many other stations in Great Britain, and therefore is at a disadvantage compared with American stations possessing ample condensing water.

The total production of electricity from public utility stations in the United States in 1927 was approximately 80,000,000,000 kilowatt-hours. In kilowatt-hours the electricity produced by the use of fuel increased about 5½ per cent, and notwithstanding that 2,500,000,000 more kilowatt-hours of electricity was generated from fuel in 1927 than in 1926, the fuel consumption decreased about 150,000 tons. The average of all steam stations was 1.83 pounds per kilowatt-hour, compared with 1.95 pounds in 1926, and our best stations consumed less than a pound of coal per kilowatt-hour. This is a wonderful record compared with that of Great Britain and indicates that private initiative is more alert and responsive in the United States than in Great Britain, where the municipalities make the better showing. There are, of course, reasons for this; but even at best Great Britain's municipal showing is only about half as good as our best privately owned system. We produced approximately 50,000,000,000 kilowatt-hours from fuel last year and consumed 45,709,000 net tons of fuel. When Great Britain's superpower system becomes effective, our cousins will be able to do better; but, owing to municipal opposition, economic reforms are hard to effect on that conservative island so important in the world's industry.

* * * *

The Salesman's Approach to the Executive

FOR a long while the sales managers of the power industry have complained of the lack of executive interest and support in their work. The executive, they say, is so absorbed in operating, engineering and finance that he will not give much thought to selling. This has been true, and because of the nature of the business in past years it is not hard to understand, for the market has always grown on insistently. But has it occurred to the commercial men that a little study of their own methods will disclose one reason why it has been so difficult to get the president or the general manager really interested in sales methods? The salesmen have not been accustomed to presenting their plans and purposes in the form that appeals to the executive.

After all, this is a business enterprise, the operation of a power company. Behind the executive stand the banker and the stockholder. When the president goes before his board of directors with a project to build a new station he must bring a full story—the necessity for it, the plan, the cost involved, the benefits to be expected, and what is involved in financing, in engineering, in operating and in organization. It is a complete picture. And that is what the president likes to see when a subordinate submits a proposition. Moreover, he is accustomed to this approach to a decision on engineering programs. Is it any wonder, therefore, that he has at times failed to react to sales plans that are reared on a substructure of enthusiasm and opportunity?

The central-station commercial man has been too inclined to feel that if he sets up a sales program and volunteers to put it over, he is doing his share of the job and can leave all questions of the capital required and how to raise the money to the chief executive, disregarding the fact that any large development of market also entails the extension of lines, the substitution of heavier transformers and feeders and often the purchase of additional station equipment. Such an attitude naturally discredits the sales department. It suggests a lack of broad judgment and responsibility. But if a proposal for a market-building project was submitted as a complete business proposition, embracing all considerations of finance, engineering, operating and sales organization and promotion, it would have a very definite reception. The executive could weigh it in its entirety. He would not have to reconcile it to other department plans, for all that would have been done in advance. It would bring new dignity to the sales department in the mind of the executive.

* * * *

Cables in Surface Trenches

DIFFERENCES between American and European practice in the installation of high-voltage cables underground have always presented an interesting question for analysis and speculation. In this country it is the almost universal practice to draw such cables into rigid underground conduits or ducts, usually placed a greater or less distance below the surface, access to the ducts being had through manholes spaced at intervals determined by the cable lengths and the mechanical stresses necessary to pull them in. Abroad it is common practice to place the cables in trenches open from the surface, the necessity thereby arising for armoring the cables against mechanical injury and for protecting the covering against various difficulties arising in the contact with the soil. The highly developed duct bank of this country obviously offers greater economy of valuable space beneath city streets. Further, there is the greater facility for inspection and for removal of defective cable sections. For these and other advantages payment must be made in the increased costs of material and construction.

An advantage of the European practice that is sometimes lost sight of is the smaller degree of handling to which the cable is subjected, particularly in the matter of bending, resulting from the simple process of unreeling into an open surface trench. This undoubtedly imposes less mechanical strain on the insulation, less probability of the breaking of paper tapes and of the formation of gas voids between insulation and sheath. With this danger lessened it is possible to wrap a tighter cable, with resulting improvement in its insulating properties. It is therefore of interest to note that at the recent meeting of the underground systems committee of the National Electric Light Association in Louisville the subcommittee on conduit and manhole construction reported two instances of the laying of cables in open trenches. In one of these cases a special concrete cable way was made, and in the other the cable was laid directly into soft earth. In each case protection from above was afforded by concrete slabs. The essential features, however, were the simplicity of the process of installation, resulting from the straight travel of the reel over the

open trench, and the economy in the matter of cost. In view of the tendency to higher voltages for underground cables and the limitations which are imposed by present methods of manufacture and knowledge as to the ultimate properties of impregnated paper, it seems not improbable that a substantial increase in voltage limits and reliability of service might be looked for by taking advantage of the increased freedom in design permitted for cables which are to be installed in open trenches.

* * * *

An Industrial Plant's Tribute to the Electrical Industry

THE manner and the extent to which electrical energy and electrical equipment are used in the fabrication of a finished product and their effect upon its quality may be accepted as the true measure of the value of the electrical industry's service to an industrial plant. A case in point is the electrification of the Timken Roller Bearing Company's plant at Canton, Ohio, where all power is purchased from the Ohio Power Company. This plant now has a maximum demand of 30,000 kilowatts, which is steadily increasing. The fact that, with such a large demand for power, the plant finds it most economical to purchase its requirements is proof positive of the superiority of central-station service under the conditions presented.

If any further proof of the value of electrical apparatus were needed, the methods of utilization and their effect upon the finished product would supply it. At this plant there is in operation a battery of electric steel-melting furnaces producing 350 tons of steel a day. All of this electric steel, and this steel only, is used in the manufacture of the company's products, although it is also operating an open-hearth furnace for the production of merchant steel. So highly does this industrial plant value the quality of electric steel that it will soon double its capacity in steel-melting furnaces. In addition to this, more than 3,000 kilowatts in electric heat-treating equipment has been installed within the past year to take further advantage of the refinements in production which electric service and electrical equipment afford. The quality of its product, its uniformity and its wide field of application in other industries are attributed by the Timken company largely to the utilization of electrical energy and electrical equipment in its own fabricating processes. Surely the electrical industry can ask for no higher tribute to the value of its own service and its own products.

* * * *

The Urban Trend in Management

GOOD relations with customers are leading to a rapid decentralization in local utility management under the holding-company principle. The rewards of putting a responsible resident manager in each important regional area are very attractive, and the policy will be continued for some time in progressive organizations. When one comes to the larger tasks of company administration, however, it is apparent that centralization of executive and technical allied and advisory functions is steadily increasing. The trend is away from the smaller town or city to the larger one or to the more conveniently located community with regard to banking connections, concentration of engineering and sales ability, access to specialist service and general business facilities.

The time is at hand when a large part of the development work of major property groups will be carried on under conditions more favorable to highly organized treatment than ordinarily obtains in the more isolated centers. Policies will be determined on the basis of local experience no less than before, but a better co-ordination will be realized in engineering, purchasing, general direction of sales activities, accounting and financing work, if strong ties between headquarters and district offices are maintained and the resources of the larger or more favorably manned centers are utilized with sound judgment and never-failing perspective. It would be ridiculous to imply that a first-class administration of a modern group of utilities cannot be conducted from a country-town office, and no such intimation is intended; but the massing of business facilities characteristic in urban centers and the increasing complexity of operating, engineering and development problems, the need of the most experienced legal advice and of the most competent financial opinion and support lie behind the present trend toward the larger city as the base of executive operations. The best resources of modern business must be made as convenient as possible to the administration of the immense aggregations of capital now invested in the light and power industry.

* * * *

Profitable Rural Service

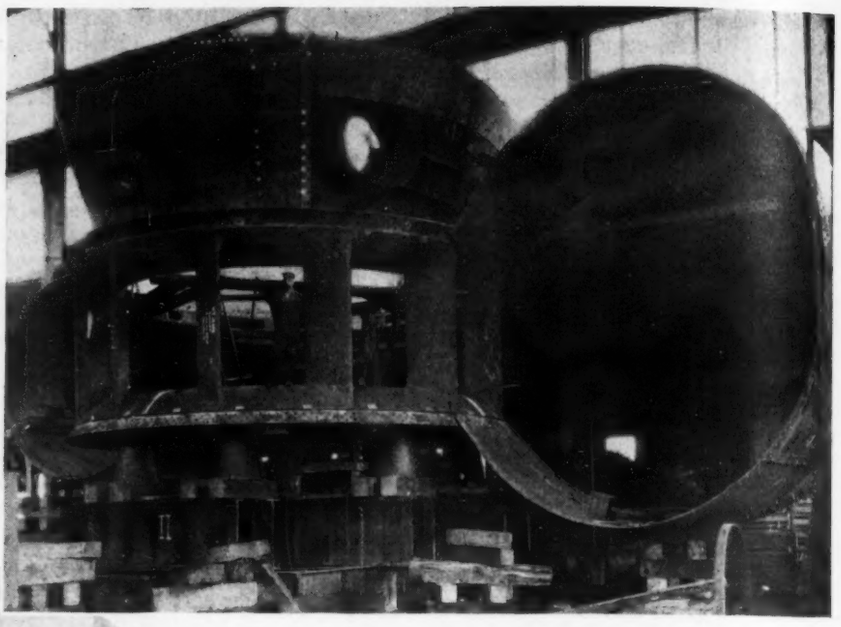
RURAL service lines, with few exceptions, are at first unprofitable. It is not unusual for such an extension to continue as a losing venture for many months, even years, after it is energized. Many suggestions have been offered to improve this condition, but the fundamental consideration cannot be avoided. A profitable line depends entirely upon the utilization of the electrical service provided by that line.

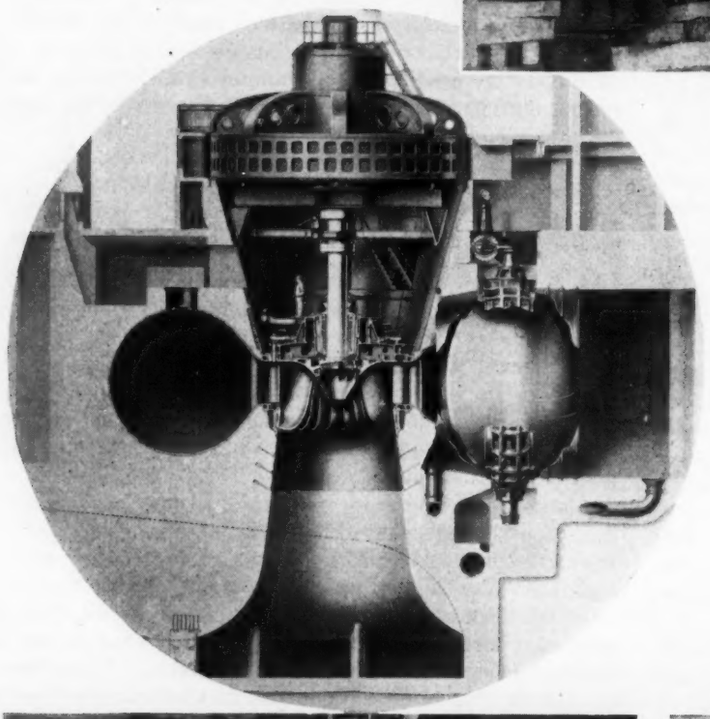
A number of operating companies in one large system have been able to shorten the period of unprofitable service through intensive efforts to have each property owner along the route "signed up" as a customer before the construction work is undertaken. The policy on this system is to start work only when 80 per cent of the potential customers have signed contracts for service. Experience has shown that such agreements can be obtained as a result of adequate effort.

There is an excellent way in which existing lines and those planned for future installation may comprise improved revenue factors. Highway-lighting practices in rural districts are consistently inadequate. A lighting load of sixteen or eighteen 600-cp. lamps per mile offers sufficient illumination to increase safety conditions along the roadway and at the same time augment the load on the extension. It is estimated that such a minimum specification represents an average annual cost of $700, and, as the highway construction requires a probable $35,000 per mile, the expenditure for illumination amounts to a potential expense increase of 2 per cent per year. A Middle Western utility supplies such a service for $48 per mile per month along 343 miles of rural roads.

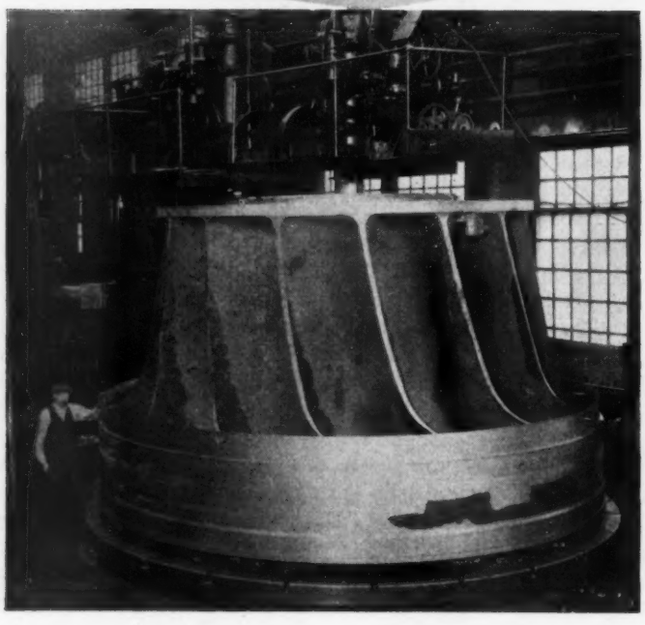
There is a certain obligation upon a community to assist in the illumination of highways just as there is a definite obligation upon it to provide the highway. Adequate lighting will place a portion of the burden of the cost of line extensions upon the members as a whole. After all, it is, definitely, a community matter, this provision of safe highways and better homes.

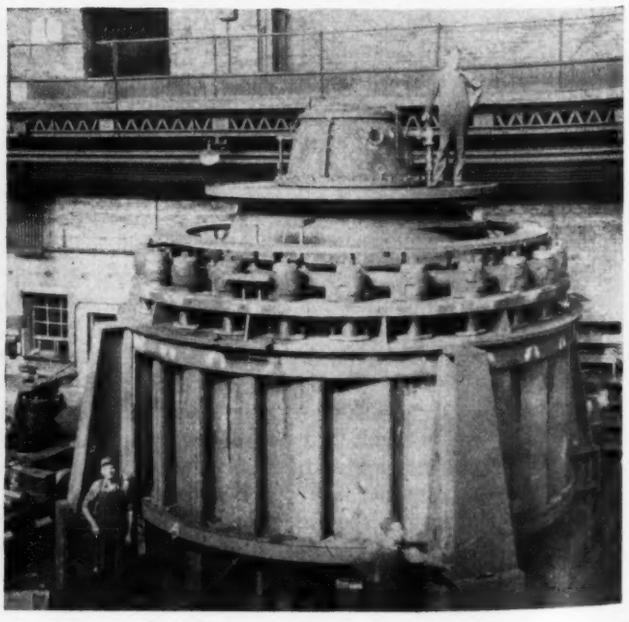
Conowingo Units Now on Line





ON MARCH 1 the Conowingo hydro-electric development of the Philadelphia Electric Company commenced feeding Philadelphia. It is tied in with the Pennsylvania Power & Light Company and will be eventually with the Public Service Electric & Gas Company of New Jersey. The plant, with its initial equipment of seven 54,000-hp. turbines designed for 89-ft. head, was completed and placed in operation in virtually two years. The total cost will be around $52,000,000. The types of runner, spiral casing and speed ring used in four of the units are illustrated.





Relation Between
Steam and Hydro Generation

Too much emphasis placed on competition.
Both types of power generation have field.
Opportunities exist for lowering hydro costs

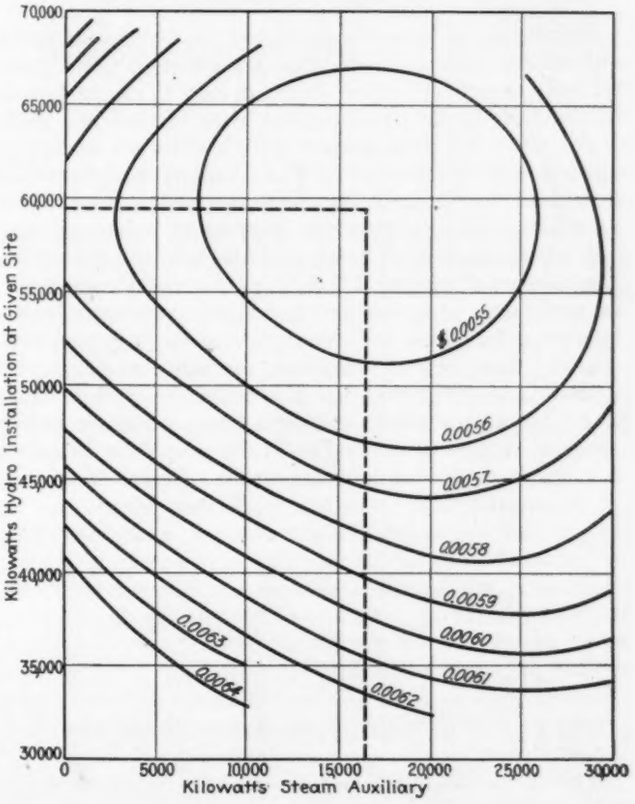
By C. P. DUNN
Chief Engineer Portland Electric Power Company, Portland, Ore.

DISCUSSIONS of problems concerning the relative economy of steam-electric and hydro-electric power generation have appeared in the technical press during the past year or two. In the opinion of the writer, the idea of steam versus hydro has been presented with too much emphasis on the thought of direct competition between the two methods of generating power. It is true that to a certain extent a direct comparison may be made, but, in general, the two methods of obtaining electric energy are inter-related in so many ways, and each makes such an admirable supplement to the other with respect to suitability for carrying different types of load, or different parts of the annual or daily system load, that in districts where both types of generation are available we must regard them as inseparable. They will remain so until a better way is invented of obtaining electric energy than from a properly balanced group of steam and hydro stations.

In districts where both sources of generation are available at reasonable cost the two working together will usually produce power more economically than either alone. The exceptions are: (a) Districts where hydro possibilities are so meager as to allow of little or no development in competition with modern steam plants, and (b) districts so favored with economical hydro sites (including storage) as to preclude the economical operation of steam plants, even for carrying peaks. This latter condition is extremely rare because of the scarcity of good storage sites. Lack of economical storage reservoir sites usually makes it necessary to have steam auxiliaries for carrying load in the low-water season.

Recent developments in automatic control have made it economical to use kilowatt-hours from small hydro sites which were formerly out of reach because of operating cost.

It is true that even in the western part of the United States, where enormous supplies of hydro energy lie undeveloped, the ratio of steam to hydro is rapidly increasing. This is the natural result of changing economic conditions. The rapid changes in methods of doing things which are taking place in all lines of human activity make it necessary to look forward, and to be flexible. The cost of new hydro has been increasing of late years because the best sites have been developed, the remaining sites of ordinary size require a greater investment per kilowatt and the rate of growth of demand for power does not yet justify the construction of the large hydro developments which can be built at a low unit cost, and which would be economical if they could be loaded quickly. The cost of steam power has been coming down because of increased efficiency due to the recent great advances in the art of generating power by steam.



Typical analysis of economic relation between size of hydro installation and steam auxiliary

Cost per kilowatt-hour of maximum usable power delivered by various combinations is shown by the "cost contours." For the given conditions covered by the chart the most economical development would be 59,000 kw. hydro and 16,500 kw. steam as shown by the dotted lines.

Some of the very large hydro-electric sites in the West appear to offer very cheap power, but when consideration is given to the fact that this apparently cheap power is located so far from the consumer that 220 kv. transmission is necessary, and construction of both generating stations and transmission lines are of a nature to require capital outlay for large steps in capacity, putting at the disposal of the consumer more power than he can use

for a period of several years, but nevertheless burdening him with the cost of having this capacity available, the picture of cheap power from falling water disappears and thought is given to steam. Steam can be installed in steps or units as small as may be desired, but the greatest thermal efficiency is not available to systems which cannot readily absorb the output of a unit of 30,000 kw. capacity or more.

The two methods of obtaining power are, in general, about on a par as to reliability. Steam-generating units alone are less reliable than hydro-generating units, but when the chances for trouble in hydro plants other than in the unit itself, such as trouble on transmission lines, trouble with ice, conduits, valves, or gates, are charged against the hydro installation they are about equal. In the case of the steam plant, there is seldom an outage due to any cause except the unit itself, because of the custom of providing spare boiler and fuel-handling equipment.

Field for Both Steam and Hydro

In comparing steam with hydro, or one hydro plant with another, there is too often a tendency among those not fully informed to give attention only to the particular development under consideration, with not enough study of the effect the development will have on the system to which it will be connected. The economic design of any individual development, if correctly worked out, must be influenced by the characteristics of all existing plants and other potential developments within reasonable transmission distance. There is no way really to measure the usefulness of a proposed development except to make detailed calculations of system operation, not plant operation. In a new development the thing to be accomplished is to build not just a plant which will produce power but a plant which will produce a certain amount of power at certain times, and to fit the new plant as nearly as possible to the work it has to do. Power spoken of as "kilowatt-hours," with no qualifying terms, has no clearly defined value. The value of a kilowatt-hour is determined not by the fact that it is a definite amount of energy, but by the ability or inability of the seller to deliver it, on demand, at any hour of the day or night or at any season of the year. Electric service consists of carrying both peaks and kilowatt-hours; the mention of either without a very specific definition of the relation between the two results in an incomplete description of the service in mind.

The cost of installation is, in the case of steam plants, from $80 to $120 per kilowatt, and in the case of hydro from $150 to $300 per kilowatt. This, with the fact that steam-operating costs and rates of depreciation are much greater than hydro, tends to make the steam plant more desirable for peak generation and the hydro plant more desirable for carrying the base of the daily load curve.

As for the contest between steam and hydro, if it may be said that a contest exists, there is usually a place for a good steam plant on the daily peak in a district where hydro is economically predominant, and there will always be a welcome extended to the intermittent hydro kilowatt-hours, which help reduce the coal bill in a district where steam is predominant. Economic laws will dictate the proper procedure in any given district.

The determination of the proper size of steam installation to suit a given set of conditions as to fixed charges, operating costs, stream flow characteristics and load characteristics is a very complicated problem. The fact that it is complicated makes it desirable to avoid decisions based on incomplete study. The only way to get a true picture of all the factors bearing on the problem, in their proper sequence and magnitude, is to analyze loads, costs and system and plant performance graphically. The accompanying chart is submitted as an illustration of graphical analysis of a problem of this nature. The detail calculations and numerous other graphs which make up the supporting data are necessarily omitted from this article.

Efficiency and Construction Costs

We read in the current discussions of steam versus hydro that there is still room for further advances in steam economy, while hydro efficiency has practically reached the ultimate, with the present 92 or 93 per cent efficiency obtainable in hydraulic prime movers. This sort of statement is only partly true and is misleading. It is true that there is room for further improvement with respect to thermal efficiency in steam plants, and some such improvement will no doubt take place in the near future. The economic benefits of this improvement will be partially offset by the gradual upward trend of fuel prices. It is true that the efficiency of waterwheels and generators has practically reached the theoretical limit, but this does not by any means indicate that the ultimate economy in hydro construction has been reached. The machinery installation represents only 10 or 15 per cent of a hydro plant; there is still an opportunity for improvement in the economic efficiency of hydraulic installations by improvement of designs of hydraulic structures, by elimination of unnecessary refinements and, greatest of all, by improvement in methods of planning and executing hydro-electric construction. The most modern hydro plant designs tend toward extreme simplicity, and more thought than ever before is being given to the cost of hydraulic structures and to the elimination of non-essentials.

Steam plant construction is relatively simple; the procedure can be standardized to some extent. A hydro-electric project presents the most difficult problems imaginable in organization and management, difficult because each project has its own individual peculiar problems which must be solved without the guide of precedent, and it is possible to standardize and systematize only to a very limited extent. These projects are nearly always managed in a creditable manner, but even where the performance has been unusually creditable, after the work is finished those connected with it can see where it might have been done more efficiently. Here, rather than in the design of machinery, is where there is room for improvement in hydro development. Because of the fact that so large a percentage of the cost of a hydro-electric project is in structures rather than in machinery, it is obvious that there is no economy in buying anything but high-grade machinery, in order that full utilization may be made of money invested in structures.

Hydro Economy Must Come Through Construction

If a hydro plant which could be built for $3,000,000 costs $4,000,000, no amount of effort expended in scientific design of the waterwheel and generator can make it a perfect plant. Even with the machinery 100 per cent efficient the plant could never attain more than 75 per cent commercial efficiency. Commercial efficiency, in its broadest sense, is the thing to be achieved. The simplification of hydro construction is being, in part, attained by carrying out the idea that a given amount of money

which is available for reserve or for protection can be spent to better advantage by installing an additional plant or unit, rather than by partial duplication of equipment in a number of plants.

The present marked increase in the proportion of steam to hydro in Western construction programs will tend to lessen the danger of communities being stampeded into disastrous public ownership ventures. The alleged "romance" is departing from hydro-electric engineering and construction. Certainly there is no romance connected with the financing of a hydro project. When this is thoroughly understood by the general public, and it becomes generally known that with very few exceptions steam generation usually enters into a truly economical scheme of things, there will be less encouragement given to the proponents of state ownership of power. With the fallacy of "harnessing the waterfall" almost at no cost exploded, there is little romance left. A man seeking office would not get many votes if he told the public that if elected he would build a steam plant with their money; somehow it has no appeal to them. In possession of the true facts they are no more likely to vote in favor of the state going into the power business than they would be to vote for state ownership of grocery stores or filling stations.

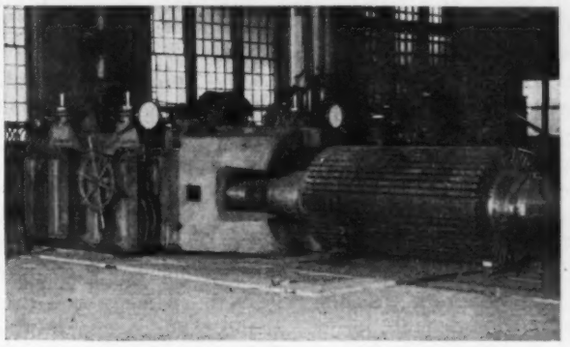
Automatic Substation Inspections

By O. M. Ward
Assistant Electrical Engineer Milwaukee Electric Railway & Light Company, Milwaukee, Wis.

THE IMPORTANCE of detailed inspections of equipment in automatic substations is evidenced by the inspection report form reproduced below, in use on the system of the Milwaukee Electric Railway & Light Company. These inspections are made at intervals of one week and the reports are made in duplicate, one copy going to the chief operator and the other kept at the substation for reference in future inspections.

Generator Rotor Assembly Improved by Bolt-Stretching Device

A HYDRAULIC machine for tightening the long axial bolts that extend through the rotors of large high-speed turbo-generators has recently been developed by the Westinghouse Electric & Manufacturing Company and has been in successful operation for several months.



Hydraulic service tightens rotor through-bolts

The rotors are composed of rolled or forged steel plates and forged shaft ends held together by long axial bolts. This construction permits the rigid inspection and test of materials necessary to safeguard the machine for high operating speeds. Previous to the use of such large rotors these axial bolts were tightened by measuring the torque applied to the nut, and later, as an added precaution, the elongation of the bolt from relaxed to loaded conditions was carefully measured. Variation in friction, either under the seat of the nut or in the threads, caused a variation in the pounds pull required to obtain the required stretch; also, the use of the wrench was awkward.

To remedy this difficulty the hydraulic machine was built with two diametrical pulling heads which permit

Items Checked on Inspection Report of Automatic Substations

Station. Date. *Master Element*—Contacts. Mechanical operation. *Time Delay Starting Relay*—Contacts. Mechanical operation. Time setting. *Master Relay*—Contacts. Mechanical operation. *Master Contactor*—Contacts. Mechanical operation. *Starting Contactor or Breaker*—Mechanical operation. Main contacts. Interlock contacts. *Auxiliary Relay for No.* — Contacts. Mechanical operation. *Polarized Motor Relay*—Lubrication of motor and gears. Brushes and commutator of motor. Mechanical operation, A contacts. B contacts. C contacts. D contacts. *Field Reversing Relay*—Contacts. Mechanical operation. *Overspeed Limit Device*—Contacts. Mechanical operation. *Synchronous Speed Device*—Contacts. Mechanical operation. *Equalizer Contactor or Breaker*—Mechanical operation. Main contacts. Interlock contacts.

Transformer—Auto-transformer, or compensator temperature relay. Contacts. Mechanical operation (check by heating element). *Alternating Current Under-Voltage Relay*—Contacts. Mechanical operation. Voltage setting. *Resistor Thermal Relay*—Contacts. Mechanical operation (check by heating element). *Annunciator Lockout Relay*—Contacts. Mechanical operation. Targets. *Field Flashing Contactor*—Mechanical operation. Main contacts. Interlock contacts. *Direct-Current, Reverse-Current Relay*—Contacts. Mechanical operation. Reverse-current setting. *Motor-Operated Master Switch*—Stationary contacts. Drum contacts. Motor lubrication. Brushes and commutator. Magnetic brake. *Brush-Operating Mechanism*—35-A or X contactor. Oil in gear case. Grease on exposed gears. Do brushes lift clear of commutator. Do brushes seat fully. Contacts. Do they make and break correctly.

Polarity Relay—Contacts. Mechanical operation. *Under-Current Relay*—Contacts. Mechanical operation. Current setting. *Bearing Thermal Relay*—Contacts. Mechanical operation (check by heating element). *Field-Killing Contactor*—Contacts. Mechanical. *Alternating-Current Machine Field Relay*—Contacts. Mechanical operation. *Field Contactor*—Upper contacts. Lower contacts. Interlock contacts. Mechanical operation. *Running Contactor or Breaker*—Mechanical operation. Main contacts. Interlock contacts. *Running Contactor Control Relay*—Contacts. Mechanical operation. *Transfer Relay, Machine Sequence Switch*—Contacts. Mechanical operation. *Emergency Starting Relay*—Contacts. Mechanical operation.

Reverse Phase or Phase Balance Current Relay—Contacts. Mechanical operation. Does relay shut down machine while in normal running position. Does relay lock out machine if it operates when machine is starting. *Single or Reverse Phase Voltage Relay*—Contacts. Mechanical operation. Does relay shut down machine while in normal running position. Does relay lock out machine if it operates when machine is starting. *Starting Protective Relay*—Contacts. Mechanical operation. Time setting. *Auxiliary Relay for No.* — Contacts. Mechanical operation. *A.C. Thermal Relays*—Contacts. Mechanical operation. *Short-Circuit Selective Relay*—Contacts. Mechanical operation. *A.C. Over-Current Relay*—Contacts. Mechanical operation. *Oil Circuit Breaker*—Main contacts. Interlock contacts. Mechanical operation.

Auxiliary Relay for No. — Contacts. Mechanical operation. *D.C. Reverse Power and Underload Relay*—Contacts. Mechanical operation. *Auxiliary Relay for No.* — Contacts. Mechanical operation. *Current Regulating Relay*—Contacts. Mechanical operation. *Voltage Regulator Relay*—Contacts. Mechanical operation. *Time-Delay Stopping Relay*—Contacts. Mechanical operation. Time setting. *Flashover Relay*—Contacts. Mechanical operation. *Motor-Operated Field Rheostat*—Contacts. Lubrication of contacts. Lubrication of mechanism and motor. Interlocks. Remarks. *D.C. Emergency Contactor or Breaker*—Contacts. Interlocks. Mechanical operation. Remarks. *D.C. Breaker or Contactor*—Main contacts. Interlocks. Mechanical operation. Remarks. *Load-Limiting Resistance, Shunting Breakers*—Main contacts. Interlocks. Mechanical operation. Remarks. *D.C. Over-Current Relays*—Contacts. Mechanical operation. Remarks. *Commutation Control Relay*—Contacts. Mechanical operation. *D.C. Voltage Direct Control Relay*—Contacts. Mechanical operation. Setting.

simultaneous stretching of two opposite rotor bolts. Each pulling head of this inverted press can exert a force of 1,000 tons. The carriage is movable and can be changed for different lengths of rotors. The motors and pumping equipment are located beneath the floor.

After the rotor is assembled temporary through-bolts are inserted. One bolt is removed at a time and the longitudinal hole reamed to an exact bore. The finished bolt is then inserted and the nuts tightened by hand sufficiently to lift the rotor. The rotor is then brought to the pulling machine. Nuts are run up until they just touch their seat, which leaves a portion of the threaded bolt still exposed. The rotor can be raised, lowered or turned by various supports. The end of one piston is visible, in the accompanying illustration, projecting through the end head, and an adapter connects the end of the piston to the threaded portion of bolt extending past the loosely run-up nut. Two diametrical bolts are pulled up to 40 per cent of final load, the nuts tightened until they relieve the stretcher of this tension, and the adapters are then removed. The rotor is turned and two more bolts treated in the same manner. Means are provided to prevent overloading the bolt.

This procedure is continued, gradually tightening the bolts in pairs until 125 per cent normal load is carried. The overloading irons out any irregularities in the structure. The rotor is then removed from the stretching machine and slotted for windings. Following this operation the rotor returns to the stretcher and the tension on the bolts is released to normal. Careful record is kept of the stretch of each bolt while in the machine and each stud is numbered for future reference.

Shooting Slag Off Boiler Tubes

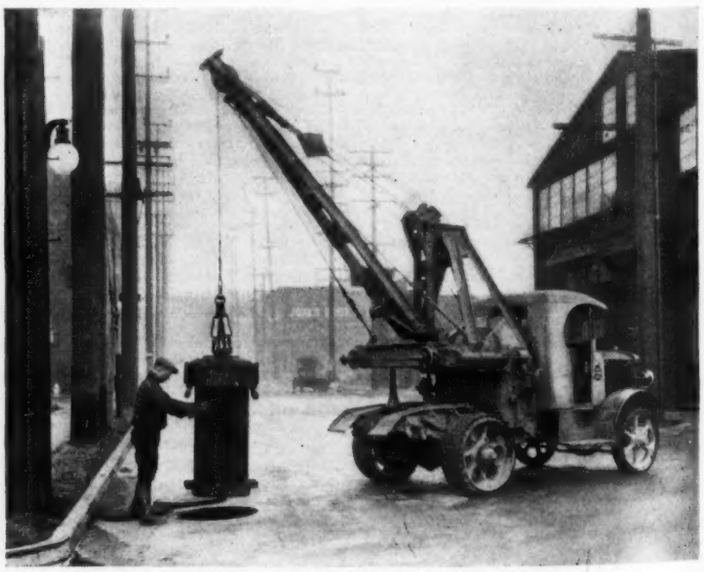
IN CONNECTION with the operation of the pioneer mercury boiler at the Dutch Point station of the Hartford Electric Light Company with pulverized coal fuel trouble was experienced last year from slag accumulation on the tips of the boiler tubes, with resultant choking of gas passes. These tubes are mounted directly above the heart of the combustion chamber, the tips being exposed to intense heating, and after shut-down the experiment was tried at the suggestion of T. H. Soren, vice-president of the company, of shooting the slag off the tube tips. Forty-six loads of No. 6 shot were fired at the mass from a shotgun, with the result that the slag was completely broken up. Following these tests on a cold boiler and setting, the shotgun was later used on a boiler in service and served to remove dense masses of slag, threatening shut-downs. It was found by these experiments that at the temperatures attained by the metal of the boiler tubes the ordinary shell load gave too high a muzzle velocity to the shot charge, with a consequent tendency to dent the tubes. The Remington Arms Company, Bridgeport, Conn., co-operated in the development of a shell to give a lower muzzle velocity, and no further difficulty occurred in the way of denting. This method of slag removal has proved thoroughly successful.

Heavy Equipment Handling Simplified by Derrick Truck

By D. A. Hord
Superintendent of Distribution Northwestern Electric Company, Portland, Ore.

ONE of the most useful pieces of equipment of the distribution department of the Northwestern Electric Company, Portland, Ore., is the truck-tractor derrick shown in the accompanying illustrations. The derrick, which was designed by the company, is entirely of structural steel with incidental steel castings. The chassis was made by General Motors and is its standard 10-ton truck-tractor, type L-10T.

The derrick is constructed to allow clearance for the gooseneck coupling of a trailer which is used for hauling heavy equipment. The framing of the derrick is so made that the mast gudgeon is directly over and coincident with the rear axle center line, giving great lifting stability. With the boom straight back and set for a 10-ft. radius it is impossible to tip the truck over when lifting the capacity load of 3 tons. The truck and derrick are utilized for many purposes, including loading, unloading and hauling poles and other material and equipment. The total cost of the equipment as shown was approximately $12,000.



Pulling cable and lowering subway transformer with truck-mounted derrick

Simplified

Distribution Planning*

Methods of calculating the economical characteristics of electrical distribution systems, particularly transformer spacing and sizes of line conductor

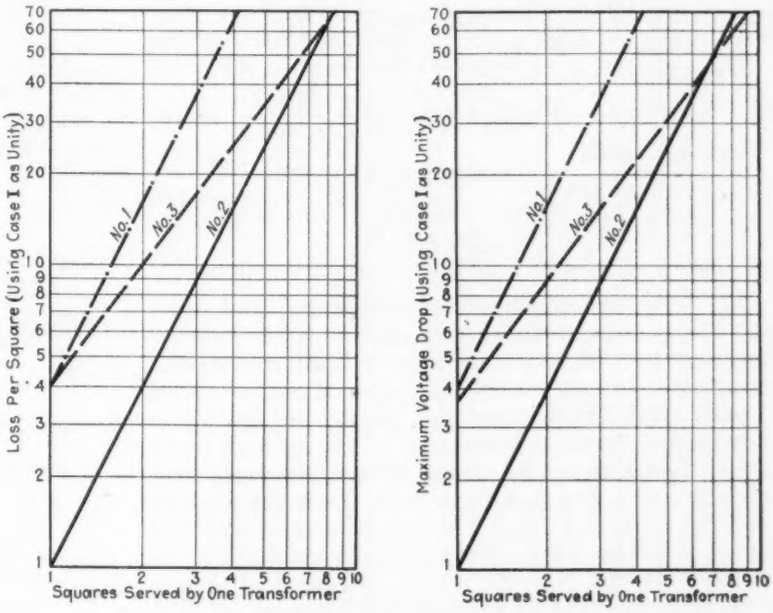
By W. R. BULLARD

Electric Bond & Share Company, New York City

IN CONSIDERING the characteristics of the secondary distribution system where the conductors have branches or network arrangements of feed simple empirical relations between transformer spacing, energy loss and voltage drop are developed. These relations are used in the development of equations of economics similar to those previously given for straight line feeds.

Where the low-voltage mains do not consist of a simple straight line of circuit the conditions are somewhat more complicated. For any particular arrangement of branches or network feeds the voltage drop and power loss can of course be calculated by means of Kirchoff's laws. Such calculations, however, lead into extremely complicated equations that are not applicable in practice to calculations of the economics of transformer spacing and copper sizes. However, a comparatively simple empirical relation between transformer size, voltage drop and power loss in a network of conductors can be derived by assuming a network formed by the intersecting streets of a district in which the blocks are exactly square, then taking several symmetrical spacings of transformers and calculating the voltage drop and power loss for each spacing.

Fig. 3 shows ideal transformer spacings for serving secondary networks from street intersections. Fig. 4 shows the same thing for cases where the transformers are placed at intermediate locations between street intersections, and Table I gives the relative values of voltage drop and power loss for the different cases shown in Figs. 3 and 4.


Loss Per Square (Using Case I as Unity)
Maximum Voltage Drop (Using Case I as Unity)
No. 1
No. 3
No. 2
Squares Served by One Transformer
Squares Served by One Transformer

Figs. 1 and 2—Power loss and maximum voltage drop in secondary mains

(One square is equivalent in length to two blocks)
No. 1—Two-way straight line feed. No. 2—Four-way network feed. No. 3—Two-way network feed.

Values thus obtained, when plotted on logarithmic paper as voltage drop or power loss versus the number of squares served by a single transformer, will within a reasonable range of values give a straight line. (See Figs. 1 and 2.) These lines, when interpreted, give exponential relations between the quantities that are mentioned.

Since the quantities involved are considerably different where transformers are located at street intersections and feed in four directions than where they are located between street intersections and feed in only two directions, two different sets of relations must be derived. Curves 3 in Figs. 1 and 2 are for the case where transformers feed in two directions only and show that, for the range between one square and eight squares served by each transformer, the power loss per square and maximum voltage drop are approximately proportional to the four-thirds power of the number of squares served.

Curves 2 are for the case where each transformer is located at a street intersection, and in this case, for the same range as before stated, the voltage drop and power loss are proportional to the square of the number of

The first article of this series appeared in ELECTRICAL WORLD, March 10, 1928; the second, March 24, 1928. The fourth and last article will be published in an early issue.

TABLE I

Case No.	No. of Squares per Transformer	Type of Feed	Maximum Current in Line	Maximum Voltage Drop	Copper Losses per Square for Fixed Cross Section
1	1	Four way	1	1	1
2	2	Four way	2	4	4
3	4	Four way	4	16	16
4	8	Four way	8	32	40
5	1	Two way	2	4	4
6	2	Two way	4	8	10
7	4	Two way	8	24	28
8	8	Two way	16	48	64

squares served, or, in other words, to the square of the size of each transformer. The larger exponent in this case is due to the fact that where the transformer feeds in four directions there are a larger number of straight line feeds and a less number of branch feeds, thus making this case almost the same as the straight line feed relation before described. Curves 1 are for a straight line feed and are included merely for comparison.

Reducing these theoretical relations to practical form and allowing a 100 per cent factor of safety, as in the previous case, we have the following equations, the second two of which contain a new term—namely L, which represents the length of block between the street intersections in 100-ft. units. This term, of course, applies to blocks that have the same dimensions in each direction—that is, square blocks—but the formulas will generally apply, in the case of rectangular blocks, if L is expressed in terms of the average length of block for both directions.

Four-way feed:

$$W = \frac{0.04575\, I_T^2}{1{,}000\, a} \qquad (1)$$

$$V = \frac{0.0685\, I_T^2}{aD} \qquad (2)$$

Two-way feed:

$$W = \frac{0.2905\, D^{3/5} L^{3/5} I_T^{4/5}}{1{,}000\, a} \qquad (3)$$

$$V = \frac{0.391\, L^{3/5} I_T^{4/5}}{aD^{1/5}} \qquad (4)$$

Due to the considerably lower voltage drop and power loss where transformers are located at street intersections and feed in four directions, it is of considerable advantage so to locate them when physical conditions will permit. This arrangement can usually be utilized in underground systems, particularly when separate transformer vaults under the street surface are used, these being located a few feet away from the street intersections, but connected to the four-way intersections of low-voltage mains by short lengths of heavy conductors. In overhead systems, however, due to congestion of lines, it is the usual practice not to install transformers on poles at street intersections, but rather to locate them on poles intermediate between the intersections. Therefore in general the four-thirds power relations given in the above equations are generally applicable to overhead systems, whereas the square relations (for four-way feeds) are generally applicable to underground systems.

In developing equations of economics of transformer spacing and copper size for cases where transformers feed individual small networks of copper the cost of primary must be taken into consideration, since, generally speaking, the amount of primary in the case of a distribution network varies with the number of transformers.

By plotting typical cases of transformer spacing it can easily be shown that the amount of primary laterals varies as the square root of the number of transformers or inversely as the square root of the size of the transformers.

If C_3 equals the annual fixed charges on the cost of primary per 100 ft. of circuit (including an allowance for additional pole height, additional hardware, insulators, etc.), then the annual cost of primary per 100 ft. of secondary in a radial system is given by the expression

$$0.707\, C_3 \sqrt{\frac{LD}{I_T}}$$

where L is the average distance between street intersections in 100-ft. units.

This expression does not take into account the cost of losses in primary laterals, but the latter are usually proportionately small in systems where the load configuration is such as to require network feeds. And in practically any case no great error will be introduced by

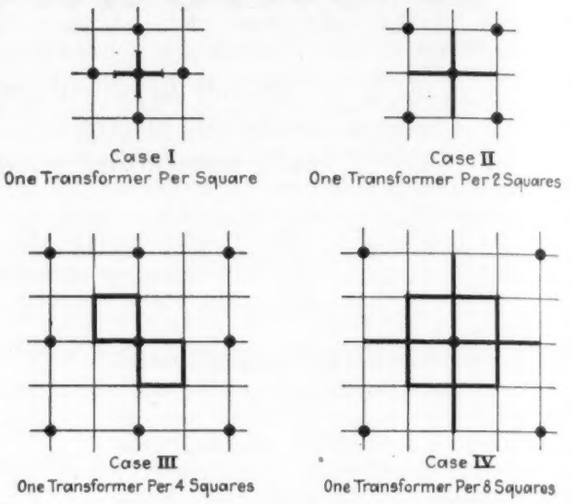


Fig. 3—Symmetrical arrangement of transformers placed at street intersections

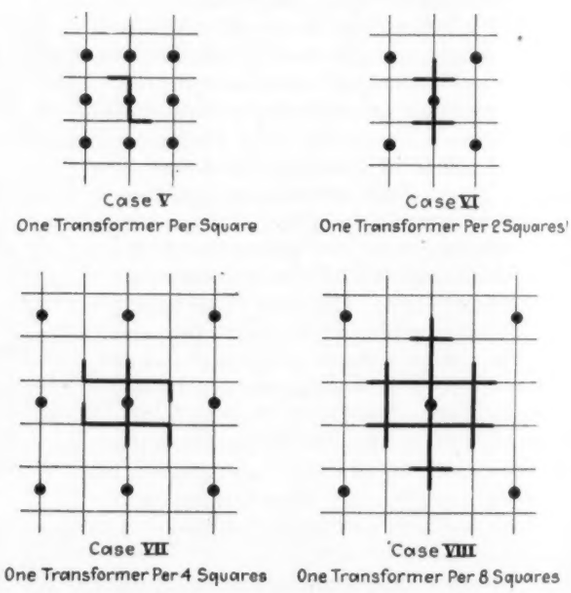


Fig. 4—Symmetrical arrangement of transformers placed between street intersections

neglecting these losses. The derivation of equations for economics of copper size and transformer spacing in network feeds using the above expression for primaries is given later in this article.

In a multiple feed network system with interlaced primaries the amount of primary lateral is dependent upon the number of feeders. However, the application of the equations derived by the use of the above expression to such a network system can easily be corrected by multiplying the estimated value of C_3 by $\left(1 + \frac{X-1}{4}\right)$ where X is the number of primary feeders serving a single network. The expression $\left(1 + \frac{X-1}{4}\right)$ is em-

pirical, but will give very nearly correct values where the interlacing of primaries is thoroughly carried out.

In a multiple feed network system with solidly interconnected secondary mains care should be taken to insure that the system characteristics selected are not such as to prevent burning off low-voltage short circuits. With thoroughly bonded cables of ordinary sizes installed in ducts sufficiently large to avoid undue crowding, it can be assumed that even a solid copper-to-copper short circuit will clear itself if sufficient current can flow to open the metallic circuit. Tests have indicated that the voltage drop along the conductor under short-circuit conditions should exceed 6 volts per 100 ft. to melt soldered joints, or 24 volts per 100 ft. to fuse the conductors. (See "Underground Alternating-Current Network Distribution for Central Station Systems," by A. H. Kehoe, *Journal A. I. E. E.*, June, 1924.) The proper value to insure the self-clearing feature of the network probably lies between these two limits. If the intermediate value of 15 volts per 100 ft. is selected, then the transformer spacing on simple straight line feeds is limited to something less than 770 ft. for systems with 115 volts nominal between line and neutral. The exact maximum allowable spacing would depend upon the relative amount of transformer and primary circuit impedance with respect to that of the low-voltage cables.

The equations for economical transformer spacing and secondary copper sizes will now be developed.

The cost of losses in the secondary conductors equals $WnfC$.

The fixed charges on cost of secondary copper equal C_2n_1a.

The fixed charges on the transformer installations and the cost of losses in the transformer equal $\frac{C_1D}{I_T}$

The fixed charges on the primary equal

$$0.707\,C_3\sqrt{\frac{LD}{I_T}}$$

The total annual cost of 100 ft. of secondary system equals

$$WnfC + C_2n_1a + \frac{C_1D}{I_T} + 0.707\,C_3\sqrt{\frac{LD}{I_T}} \qquad \textit{(Formula b)}$$

Only those costs which vary with the size of copper and transformer spacing are included in the above formula.

Economics of Four-Way Network Feed

Substituting the value of W from equation 1 in formula b we have:

$$\text{Total cost} = \frac{0.04575\,I_T^2}{1{,}000\,a} + C_2n_1a + \frac{C_1D}{I_T} + 0.707\,C_3\sqrt{\frac{LD}{I_T}} \qquad \textit{(Formula c)}$$

For Complete Economics.—A size of secondary conductor must be found that reduces the sum of the cost of copper losses and fixed charges on copper to a minimum with a given value of I_T.

By equating the derivative of $\frac{0.04575\,I_T^2}{1{,}000\,a} + C_2n_1a$ with respect to a to zero and solving for a we get:

$$a = 0.00676\,I_T\sqrt{\frac{nfC}{n_1C_2}} \qquad (5)$$

Substituting the expression in formula c, we have:

Total cost =

$$0.01352\sqrt{nn_1fCC_2}\,I_T + \frac{C_1D}{I_T} + 0.707\,C_3\sqrt{\frac{LD}{I_T}}$$

Differentiating the total cost with respect to I_T and equating to zero, we have an expression of the form:

$$A_2 = I_T^2 - B_2I_T^{1/2} \qquad (6)$$

where
$$A_2 = \frac{74\,C_1D}{\sqrt{nn_1fCC_2}} \qquad (7)$$

and
$$B_2 = \frac{26.15\,C_3\sqrt{LD}}{\sqrt{nn_1fCC_2}} \qquad (8)$$

Graphical solutions for equation 6 and subsequent working equations will be given in the fourth of this series of articles.

If Voltage Drop Determines the Size of Conductors.—If it is desired to design a system for the most economical characteristics that will give a certain voltage drop, we have, by substituting the value of a from equation 2 $\left(a = \frac{0.0685\,I_T^2}{DV} \text{ equation } 9\right)$ in formula c and differentiating:

$$\frac{d(Total\ Cost)}{d(I_T)} = \frac{0.137\,C_2n_1I_T}{DV} - \frac{C_1D}{I_T^2} - \frac{0.3535\,L^{1/2}D^{1/2}C_3}{I_T^{3/2}}$$

Equating to zero, we get an expression of the form:

$$A_3 = I_T^3 - B_3I_T^{1/2} \qquad (10)$$

where
$$A_3 = \frac{7.3\,C_1VD^2}{n_1C_2} \qquad (11)$$

and
$$B_3 = \frac{2.58\,C_3VL^{1/2}D^{3/2}}{n_1C_2} \qquad (12)$$

If Current-Carrying Capacity Limits the Size of Conductors.—If the current in the secondary nearest to the transformer, $\frac{I_T}{4}$, derived from the above equations exceeds the current-carrying capacity of the conductor, the equations must be applied which are derived by first limiting the size of a to the proper function of I_T from a heating standpoint.

The value of a when it is limited by temperature in underground conductors is given approximately by

$$a = \frac{I_T^2b}{160{,}000} \qquad (13)$$

Substituting the value of a from equation 13 in formula c and differentiating, we have:

$$\frac{d(Total\ Cost)}{d(I_T)} = \frac{C_2n_1bI_T}{80{,}000} - \frac{C_1D}{I_T^2} - \frac{0.3535\,L^{1/2}D^{1/2}C_3}{I_T^{3/2}}$$

Equating to zero, we get an expression of the form

$$A_4 = I_T^3 - B_4I_T^{1/2} \qquad (14)$$

where
$$A_4 = \frac{80{,}000\,C_1D}{C_2n_1b} \qquad (15)$$

and
$$B_4 = \frac{28{,}280\,C_3\sqrt{LD}}{n_1bC_2} \qquad (16)$$

Economics of Two-Way Network Feed

Substituting the value of W from equation 3 in formula b, we have for the total cost:

$$\frac{0.2905\,nfCD^{2/3}L^{2/3}I_T^{4/3}}{1{,}000\,a} + C_2n_1a + \frac{C_1D}{I_T} + 0.707\,C^3\sqrt{\frac{LD}{I_T}} \qquad \textit{(Formula d)}$$

For Complete Economics.—The size of secondary conductors a must be found that will reduce the sum of the cost of copper losses and fixed charges on copper to a minimum with a given value of I_T.

By equating the derivative of $\frac{0.2905\, nfCD^{2/3}L^{2/3}I_T^{4/3}}{1{,}000a} + C_2n_1a$ with respect to a to zero and solving for a we get:

$$a = 0.01703 \sqrt{\frac{nfC}{n_1C_2}}\, D^{1/3}L^{1/3}I_T^{2/3} \qquad (17)$$

Substituting this expression in formula d, we have

$$\text{Total cost} = 0.0341\sqrt{nn_1fCC_2}\, D^{1/3}L^{1/3}I_T^{2/3} + \frac{C_1D}{I_T} + 0.707\, C_3\sqrt{\frac{LD}{I_T}}$$

Differentiating the total cost with respect to I_T and equating to zero, we have an expression of the form:

$$A_5 = I_T^{5/3} - B_5I_T^{1/2} \qquad (18)$$

where $$A_5 = \frac{44\, C_1}{\sqrt{nn_1fCC_2}}\left(\frac{D^{2/3}}{L^{1/3}}\right) \qquad (19)$$

and $$B_5 = \frac{15.58\, C_3L^{1/6}D^{1/6}}{\sqrt{nn_1fCC_2}} \qquad (20)$$

If Voltage Drop Determines the Size of Conductors.—If it is desired to find the most economical characteristics that will give a certain voltage drop, we have, by substituting the value of a $\left(a = \frac{0.391\, L^{2/3}I_T^{4/3}}{VD^{1/3}}\right.$ equation 21$\left.\right)$ from equation 4 in formula d and differentiating:

$$\frac{d(\text{Total Cost})}{d(I_T)} = \frac{0.521\, C_2n_1L^{2/3}I_T^{1/3}}{VD^{1/3}} - \frac{C_1D}{I_T^2} - \frac{0.3535\, L^{1/2}D^{1/2}C_3}{I_T^{3/2}}$$

Equating to zero, we get an expression of the form:

$$A_6 = I_T^{7/3} - B_6I_T^{1/2} \qquad (22)$$

where $$A_6 = \frac{1.92\, VC_1D^{4/3}}{n_1C_2L^{2/3}} \qquad (23)$$

and $$B_6 = \frac{0.678\, C_3VD^{5/6}}{n_1C_2L^{1/6}} \qquad (24)$$

If Current-Carrying Capacity Limits the Size of Conductors.—If the current in the secondary nearest to the transformer exceeds the current-carrying capacity of the conductors, then equations must be applied that are derived by first limiting the size of a to the proper function of I_T, from a heating standpoint.

The value of a when it is limited by temperature in overhead conductors is given by:

$$a = \frac{I_T^{4/3}b}{1{,}170} \qquad (25)$$

Substituting the value of a from equation 25 in formula d and differentiating, we have:

$$\frac{d(\text{Total Cost})}{d(I_T)} = \frac{4\, n_1bC_2I_T^{1/3}}{3 \times 1{,}170} - \frac{C_1D}{I_T^2} - \frac{0.3535\, L^{1/2}D^{1/2}C_3}{I_T^{3/2}}$$

Equating to zero, we get an expression of the form:

$$A_7 = I_T^{7/3} - B_7I_T^{1/2} \qquad (26)$$

where $$A_7 = \frac{877.5\, C_1D}{C_2n_1b} \qquad (27)$$

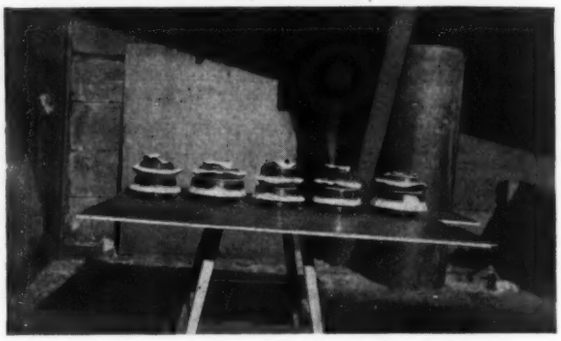
and $$B_7 = \frac{310\, C_3}{C_2n_1b}\sqrt{LD} \qquad (28)$$

Broken Insulators Withstand Normal Voltage

By R. Rader

Office Engineer Puget Sound Power & Light Company, Seattle, Wash.*

TO TEST the ability of modern pin-type insulators for operating voltages of 50-70 kv. to withstand normal voltage after the shells have been broken off, a condition which may obtain under operating conditions due to rocks being thrown at insulators or the petticoats being shot off, the Puget Sound Power & Light Company tested a few standard types for wet and dry flashover under this extreme condition. New insulators of five makes were selected and the shells broken off with hammer blows. Each type was treated as nearly equally as possible, as shown by the accompanying illustration. One of the specimens was exceptionally brittle.



Pin-type insulators stripped of shells and subjected to flashover tests to simulate line conditions which may obtain

After stripping, the remains were subjected to dry and wet flashover tests in accordance with A.I.E.E. standards. The wet tests were conducted after the dry tests had been completed and after the insulators had been sprayed with water for five minutes while in an upright position. The initial voltage for the dry tests was 30,000 volts, which was raised in increments of 1,000 volts per second until flashover occurred. The wet tests began at 15,000 volts, the voltage being increased at the same rate as in the dry tests. Results are given in the following table:

Insulator (Reading from Left to Right in the Illustration)	Dry Flashover Voltage	Wet Flashover Voltage
No. 1	73,500	39,000
No. 2	72,000	32,000
No. 3	72,000	31,000
No. 4	73,000	35,000
No. 5	73,000	32,000

The dry flashovers show a remarkable uniformity, as opposed to the wet flashover values. It seems that the insulator design has much to do with the flashover values even with the shells removed. The company's standard specifications now contain the clause: "The general design of insulators shall be such that when all the outer rims are stripped off by breakage the insulators will not have a wet flashover value less than maximum operating voltage of the classification specified."

**Stone & Webster, general managers.*

Useful Nomogram for Photometric Work

By Hempstead S. Bull
Instructor in Electrical Engineering
University of Michigan

THE accompanying chart provides a means of obtaining the zonal lumens output of a luminaire when its polar candle power distribution curve is available. This method possesses, in addition to the inherent advantages of all nomographic charts, a feature in common with the Rousseau diagram which facilitates accurate work, in that zones of varying central-angular width may be selected to conform to the irregularities of the candlepower curve.

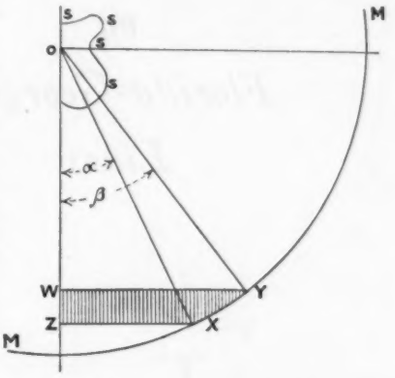
In the figure is shown half of a typical candlepower distribution curve S. Let M M be a portion of the surface of a sphere inclosing the light source and with its center at the center of the light, O.

OX and OY are the traces of two coaxial cones making angles a and b respectively with the axis. It is known that the solid angle at O subtended by the zone $XYWZ$ on the surface of the sphere is equal to 2 (cos α—cos β).

To obtain the lumens output in this zone it is necessary to multiply the solid-angular content of the zone in steradians by the average candlepower for the zone as obtained directly from the candlepower distribution curve. This process can be carried out graphically on the accompanying nomogram.

Two references on nomograms or alignment charts:
"Graphical and Mechanical Computation," Joseph Lipka; Wiley & Sons.
"Alignment Charts for Engineers and Students," Kearton and Wood; Griffin, London.

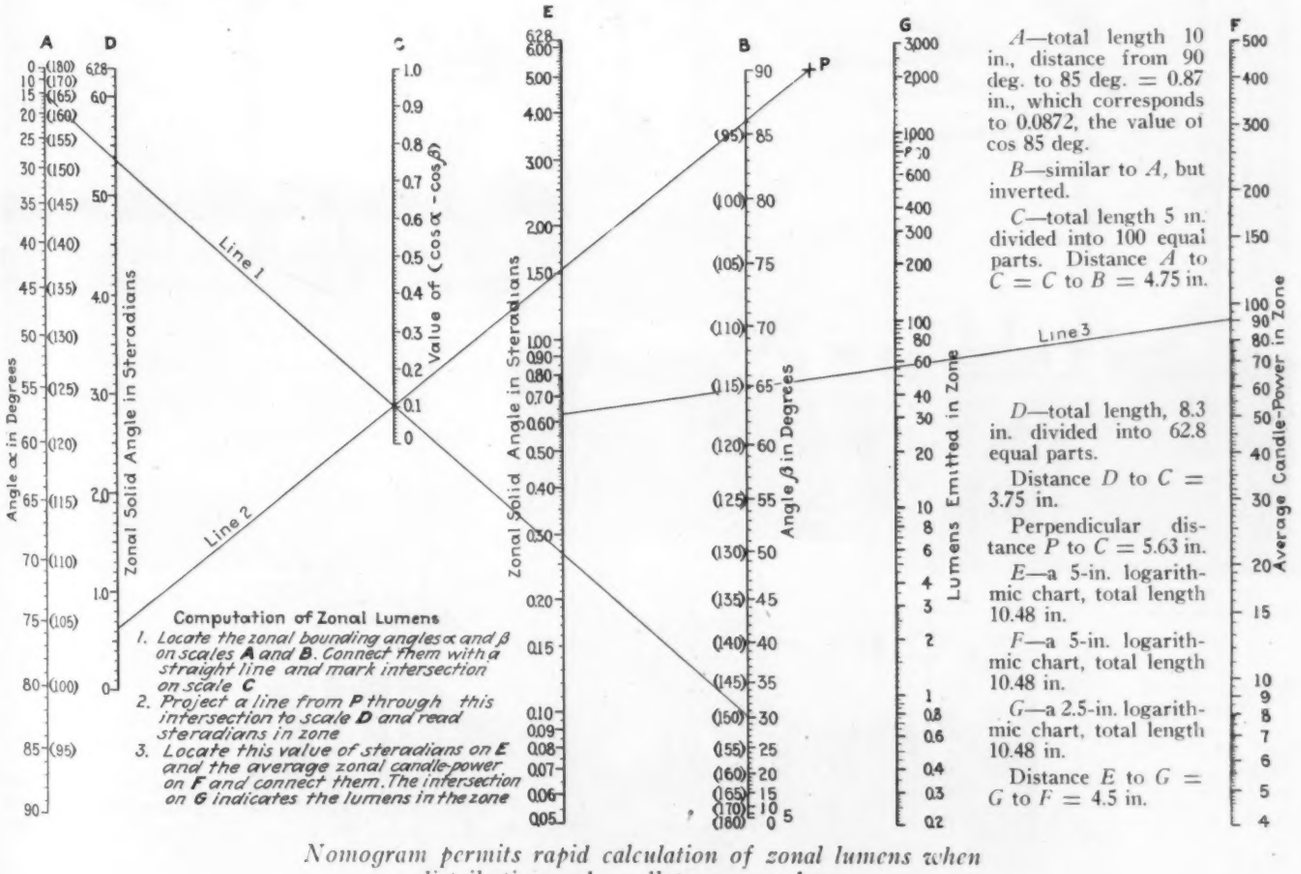
Scales A, B and C form a subtraction chart by which the quantity (cos α—cos β) can be determined for any values of α and β. The value of this quantity can then be transformed to steradians by multiplying by 2, which process is performed by projecting from P through the value on scale C to scale D. Scales E, F, and G form a multiplication chart by which the product of steradians times average candlepower can be carried through to obtain zonal lumens. It is merely necessary to set the value of steradians on scale E as soon as it is obtained on scale D, and the candlepower value on F, and read lumens output on G.



Typical candlepower distribution

For example, let the values of α and β be 15 deg. and 30 deg. respectively. Line 1 drawn through these points on scales A and B cuts C at 0.10 and line 2 drawn from P through 0.10 on C cuts D at 0.63. Line 3 drawn from the value 0.63 on scale E to the value of the average candlepower for this zone, which was here assumed to be 90, cuts scale G at 56.5, which is the value of lumens emitted in this zone.

The original of the accompanying chart covers most of a 12 x 19 sheet. For the information of any one wishing to reproduce this chart to the original scale the dimensions of the various scales used are given below.


A
D
C
E
B
G
F
Angle α in Degrees
Zonal Solid Angle in Steradians
Value of (cos α - cos β)
Zonal Solid Angle in Steradians
Angle β in Degrees
Lumens Emitted in Zone
Average Candle-Power in Zone
Line 1
Line 2
Line 3
P
Computation of Zonal Lumens
1. Locate the zonal bounding angles α and β on scales A and B. Connect them with a straight line and mark intersection on scale C
2. Project a line from P through this intersection to scale D and read steradians in zone
3. Locate this value of steradians on E and the average zonal candle-power on F and connect them. The intersection on G indicates the lumens in the zone

A—total length 10 in., distance from 90 deg. to 85 deg. = 0.87 in., which corresponds to 0.0872, the value of cos 85 deg.

B—similar to *A*, but inverted.

C—total length 5 in. divided into 100 equal parts. Distance *A* to *C* = *C* to *B* = 4.75 in.

D—total length, 8.3 in. divided into 62.8 equal parts.

Distance *D* to *C* = 3.75 in.

Perpendicular distance *P* to *C* = 5.63 in.

E—a 5-in. logarithmic chart, total length 10.48 in.

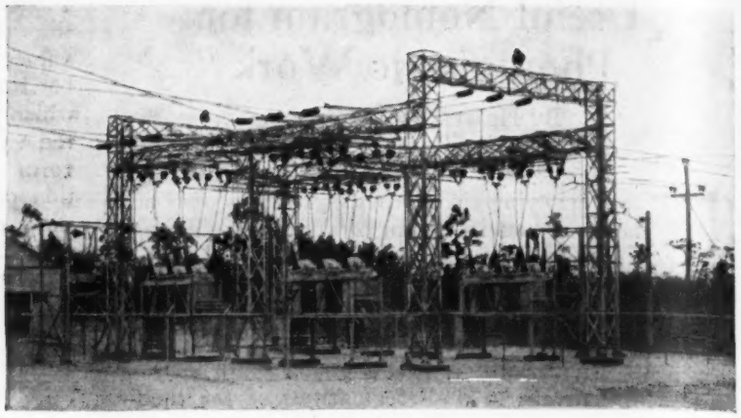
F—a 5-in. logarithmic chart, total length 10.48 in.

G—a 2.5-in. logarithmic chart, total length 10.48 in.

Distance *E* to *G* = *G* to *F* = 4.5 in.

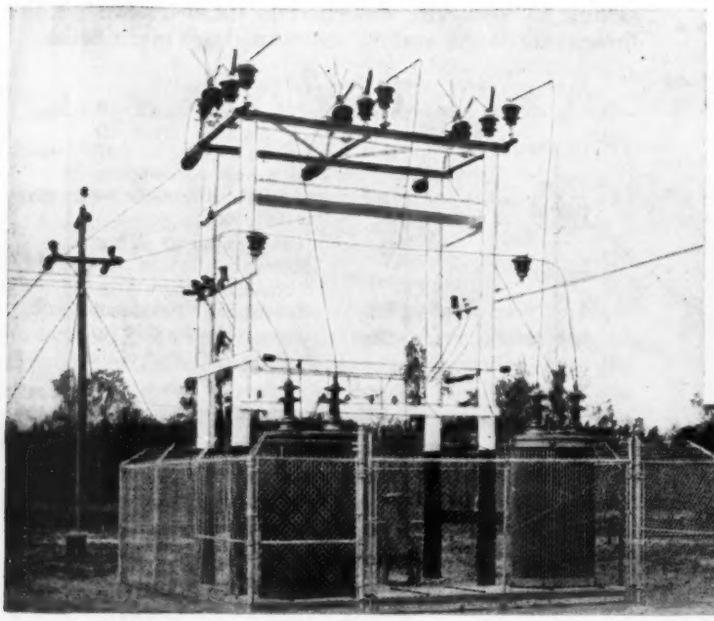
Nomogram permits rapid calculation of zonal lumens when distribution and candlepower are known

Construction Practices on Florida-Georgia Lines

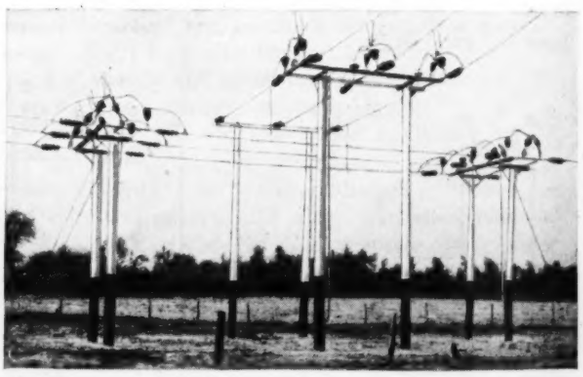


Standard 66-kv. steel switching structure at Croom, Fla.

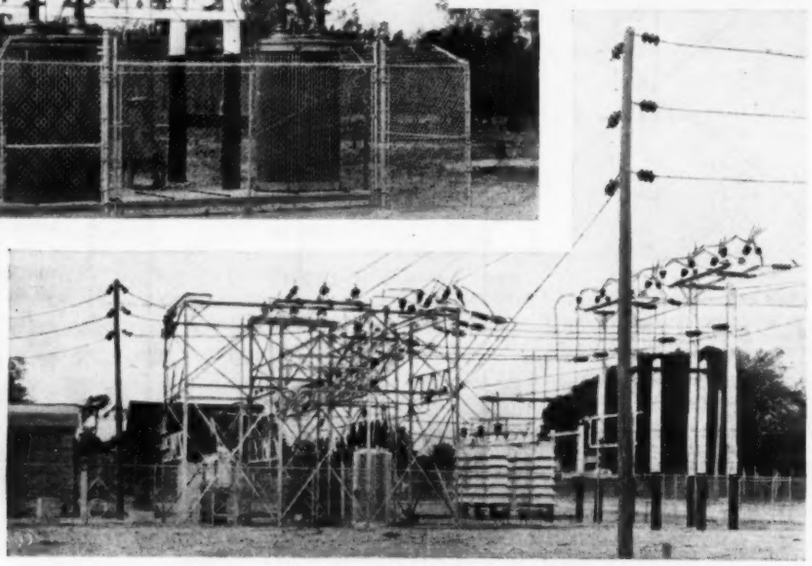
THE methods of erecting the new Southern lines of the National Public Service System were described by M. J. Idail and C. E. Bland in the March 17 issue of ELECTRICAL WORLD. The structures used for substations, 110-kv. transmission towers and 66-kv. pole lines vary with local conditions and representative types are shown in the accompanying illustrations. In order to keep the standard of service in step with the increased load, certain existing lines were reinforced and revamped. The interconnection of relatively small isolated properties and the new 25,000-kw. base-load power station at Inglis was accomplished in this construction program. After the completion of this work there were more than 730 miles of 66-kv. line and 178 miles of 110-kv. trunk line.



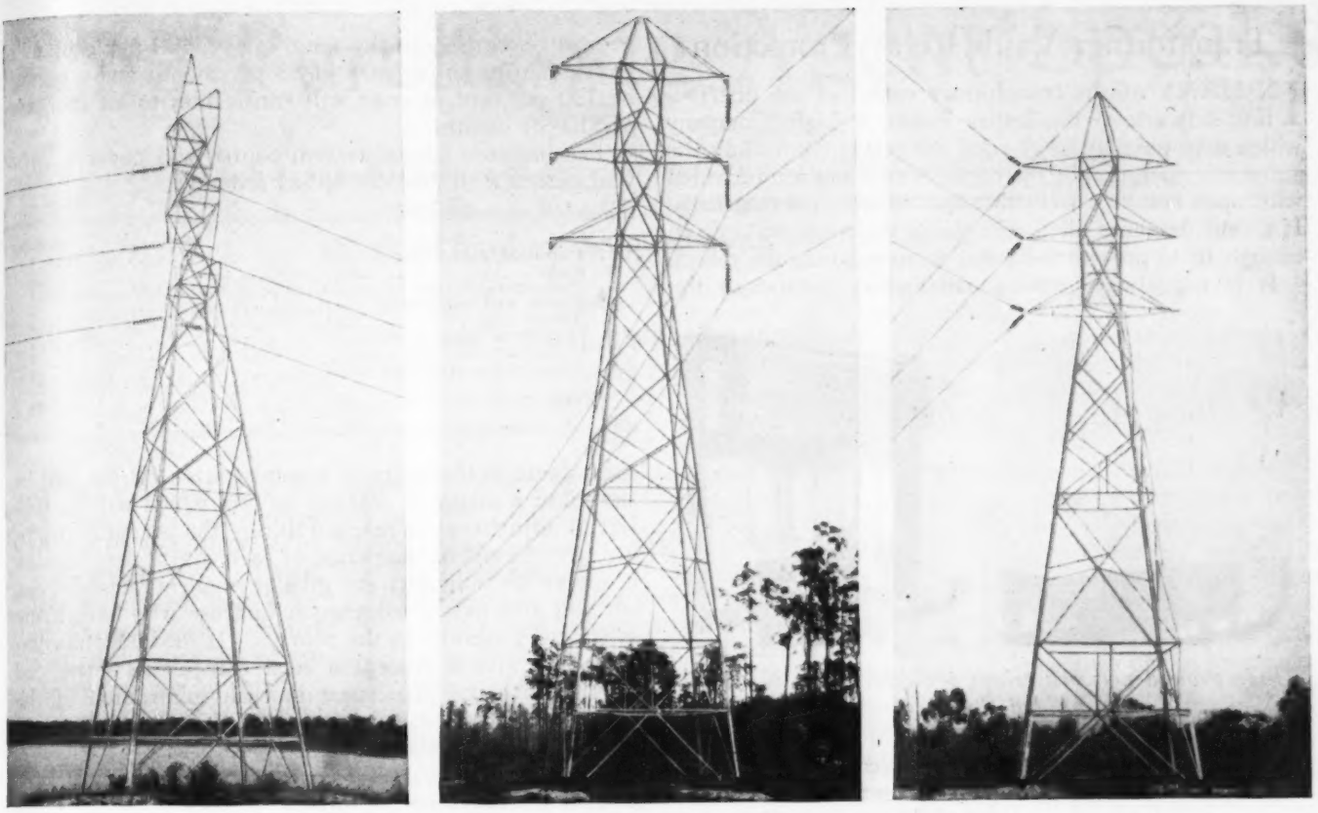
Standard 66-kv. wood-pole substation at Inverness, Fla.



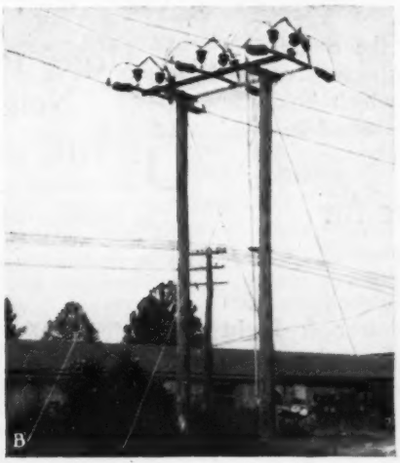
66-kv. switching station at Wildwood, Fla.

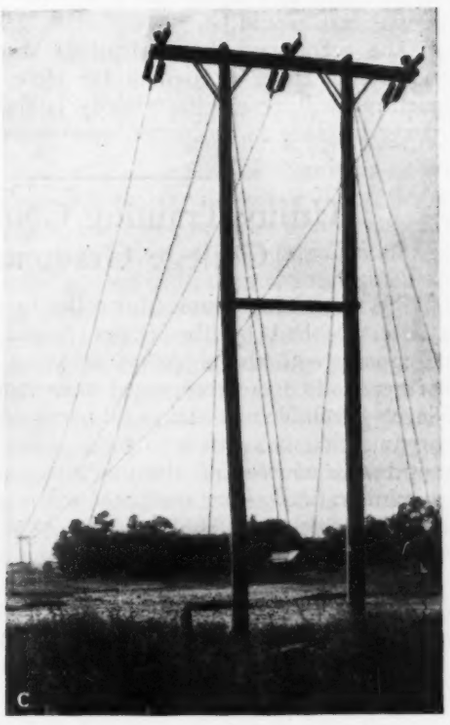


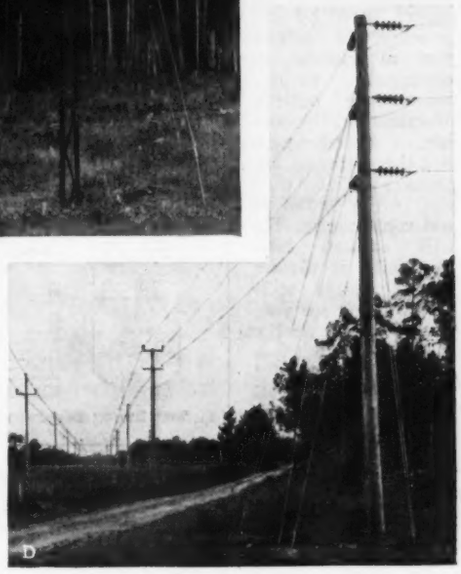
Combination wood and steel station under construction at Leesburg, Fla.

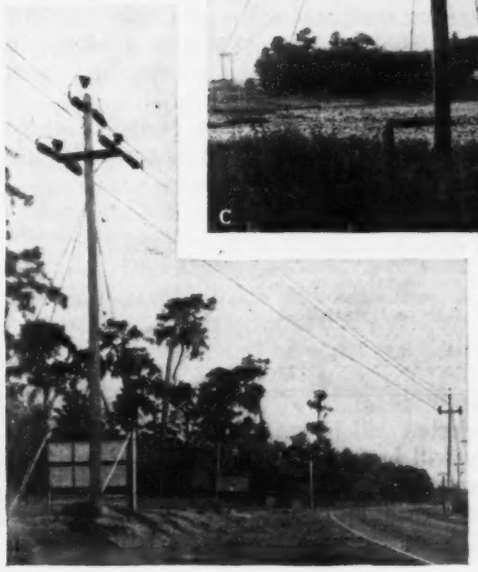


110-kv. dead-end, tangent and angle (over 5 deg.) tower construction









A — 44-kv. steel pole line rebuilt for 66-kv.

B—Standard line sectionalizing switch

C — Typical 66-kv. long-span construction

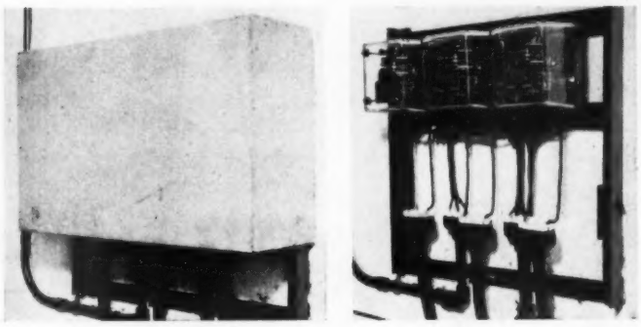
D—66-kv. wood-pole line

E — 66-kv. road crossing showing dead-end construction

Transformer Vault Relay Protection

IN MANY of the transformer vaults of the distribution network of the Dallas Power & Light Company which may possibly be flooded the relays controlling the automatic operation of the network switches are provided with open bottom covers that are, in effect, diving bells. If a vault becomes filled with water the cover will entrap enough air to prevent the water from reaching the relays.

It is not always wholly satisfactory to inclose the



Underground network relays protected from water by welded steel case

relays in air- and water-tight cases because of the effect of temperature rise due to lack of ventilation. Ventilation is provided by the open bottom cover and it is just as effective in keeping the relays out of the water as a closed case would be.

The accompanying illustrations show the manner in which the cover is used and a close inspection of the pictures will reveal the gravity latches which hold the cover in place as the water rises in and around it.

Utility Training Course for College Graduates

TWO training courses for college graduates have been established by the Puget Sound Power & Light Company with the object of selecting a limited number of graduates from recognized universities from which to develop suitable material to fill permanent positions in the organization from time to time. One is an engineering apprentice course and the other is a course in business administration. The company will make selections for both courses from students who expect to graduate in June and who file applications prior to specified dates early in the calendar year.

The engineering course will cover a period of three years with allotment of time according to the following schedule:

	Months
1. Testing and inspection—service division	6
2. Engineering plans	8
3. Construction and installation	8
4. Operation and maintenance	6
5. Sales, accounting and statistical	6
6. Elective	2
Total	36

Applicants selected will be started at $100 per month and their salary will be adjusted at the end of each six months on a merit rating basis. Men will be rated from 70 to 130 per cent of a normal average. A rating of 80 per cent will be necessary for the man to continue in the company's employ at the same salary, 100 per cent will entitle him to an increase of $5 per month and a rating of 120 per cent or over will entitle him to an increase of $10 per month.

The business administration course will cover a two-year period with time divided as follows:

	Months
1. Purchasing and stores	4
2. Sales	2
3. Customers' billing	3
4. Credit and collections	2
5. Accounting	6
6. Insurance department	1
7. Corporate subjects	5
8. Personnel department	1
Total	24

Students in the business administration course will be started at a salary of $90 per month, which will be subject to adjustment as merited during the period of training. At the end of the period of each course the company is under no obligation to give permanent employment, but will give first consideration to those who have made satisfactory records in the courses. If desired, the company will give a student a certificate on its letterhead setting forth the time spent in each subdivision of the course and a statement of the ability, personality and qualifications of the individual.

The proposed courses have been prepared after very careful consideration of similar courses given by other utilities.

Urges Public Acquaintance with Neighborhood Contractor

ON THIS advertisement run by the Edison Electric Illuminating Company of Boston it says:

The electrical contractor or dealer in your neighborhood is a man well worth knowing. He realizes his success depends upon his service to the community—to you. He is ready to place his experience and knowledge at your disposal, so that you may have the greatest benefit from electricity in every way. Let him help you; consult him on all your electrical requirements.

ELECTRICAL CONTRACTOR DEALER
YOUR ELECTRICIAN
brings you Comfort and Convenience
RELY UPON YOUR ELECTRICIAN
THE EDISON ELECTRIC ILLUMINATING CO. OF BOSTON

Your electrician is more than a skilled workman; he is an expert, fitted by experience to advise you in regard to electrical wiring, convenience outlets, illumination, cooking, refrigeration and the scores of appliances that give you every comfort and convenience. He will explain how electricity is always ready, always willing to work for you, day or night, at the snap of a switch—an economical, useful force. Let him tell you how to expand your present electrical service so that it may give you more leisure and freedom. From the modest home in the suburbs to the largest factory in the city, electricity is performing a useful service. Is it doing all it can for you? Ask your electrician.

The Purchasing Agent Speaks

A frank discussion of some of the causes of price cutting in this buyers' market. A bit of background and a few suggestions from the head of the purchasing agents' association

By Lewis A. Jones

Vice-President New York Power & Light Corporation and President of the National Association of Purchasing Agents

The subject of price cutting is under very general discussion. For the purpose of crystallizing some of the principles and practices involved, two articles by Earl Whitehorne have been published in recent issues of the Electrical World, *one entitled "Who Pays the Cost of Price Cutting?" the other "Some Experiences in Price Cutting." Many interesting letters of comment and criticism have been received from both buyers and sellers and will form the basis of further recommendations upon this theme. Meanwhile, this message from the head of the national organization of the purchasing agents is pertinent and interesting as a frank opinion.*

I HAVE read your recent article entitled "Who Pays the Cost of Price Cutting?" It is most interesting. I have a lot of things which I would like to say, but which are difficult to put on paper.

I have no grievance against the sales organizations of the country, but I have many thoughts based upon some sad experiences which I have discussed much and often with venders. Unless carefully expressed, they would carry, perhaps, an impression of a controversial attitude, which I want to avoid. This feeling is based simply upon the fact that I think the day must come when the purchasing agents of the country and the sales organizations will get together and study some of their mutual problems, in a definitely constructive frame of mind. This is as it should be, and this year, as president of the National Association of Purchasing Agents, I have had a definite plan to call together some of the leading industrial executives to discuss this very topic. So much for the preliminaries.

I believe this article to be thoroughly constructive in its intended purpose. Of course, with a just amount of pride in my work, it hurts to have implications made against purchasing agents. I know all too well, however, that there are men in our work who do represent the attitude which you emphasize. These, however, I do earnestly believe are becoming each year fewer in number. Through our national association a vast amount of good is being done to recognize the ethics and economics of the problem.

A Bit of Background

There are about 8,000 concerns in the country, I believe, whose annual purchases amount to a million dollars or over and who may properly be supposed, therefore, to maintain central purchasing departments. There are nearly 5,000 men holding membership in our national association. About 60 per cent of every transaction is represented by purchase function, 20 per cent sales and 20 per cent executive. In the old days of barter, selling was recognized as the primary function, and in its activity was considered ahead of production and of purchasing. Of necessity, as the industrial picture expanded, sales took precedence over other activities in the minds of the public because of the prominence of advertising. Salesmen also were among the first to organize.

The executives did most of the buying, and later, as industry developed, men or clerks were given the title of "purchasing agent." But they were too often designed by the executive not from the standpoint of efficiency but to give some man a job, or identify a certain part of his business, while he himself still really carried on the activities. There are still examples of this practice, too. The natural result was that sales organizations rebelled at being asked to deal with men having no authority, and in a very natural way were forced, in order to meet the requirements of their own companies, to go over the head of the so-called purchasing agent. Still being handicapped, they began to go into the shops and the factories, to see the foremen, and in every possible way to seek direct contact. In this respect purchasing agents themselves were to blame largely, because instead of working with these men they attempted to establish a position, a dignity and a name which they had not earned, and which the executives had not given them. Instead of working frankly and openly with the salesmen they antagonized them. This practice is still in vogue in many similar fields and is a "thorn in the flesh" of those men in the purchasing work who have a larger vision.

Because of all this, sales organizations have been and are in a great degree very antagonistic to the purchasing work. I well recall at one of our national conventions, when a certain sales organization was asked to provide a speaker on our program, it sent an advertising man to come before us, and he spent the entire time allotted to him in telling us of our faults, condemning our attitudes and emphasizing the high qualifications of salesmanship as against the evil practices of purchasing. Where we had looked for a constructive piece of work and a chance to co-ordinate our activities, we were driven farther apart.

Sales managers today send men out on the road who

are very poorly prepared. In my office, for instance, we interview many hundreds of men in the course of a month, and they are a most exceptional lot, I believe, in character and capabilities. And I find that in almost every instance where they are not prepared to give me the information and service which I have a right to expect when I grant an interview, it is almost entirely the fault of the sales manager or the executives back in the home office. My sympathy is completely with the man on the road, who, if his concern functions properly, should be to me the main point of contact and should represent his concern in all that is best of constructive thought, effort and service.

Need for Authority

When you ask "Who is at fault?" each side will answer that the other man holds the crown. But as I have spent a great many hours in thinking about and discussing this problem, as I have met hundreds of purchasing men at our public utility meetings, at our national conventions, in their private offices, in community work, etc., I have in the last eleven years found a marvelous improvement in the caliber of purchasing men, and great anxiety for the improvement of the ethics of our work. We have a high type of men in every way. From among their number there are being selected today some of the highest executives of industry. For instance, A. L. Salt, for years purchasing agent of the Western Electric, is now the president of the Graybar Electric Company. There are many others. I do not in any way evade or overlook the methods of small-caliber purchasing men, but you will find an equal number or more in the ranks of salesmen.

Who is most at fault, the buyer or the seller? I think it is at least a 50-50 break and needs only a Moses in industry to eradicate 90 per cent of the misunderstandings which exist today. This Moses, however, will have to improve the ethics of selling as definitely as he improves the ethics of buying, and I firmly believe that this can be done through a co-ordinated effort on the part of the executives, working with and through purchasing departments as definitely as they work with their sales organizations.

The trouble is that so many executives give the men the title of "purchasing agent" and then withhold the authority. And I can speak quite frankly here, because in my own work I think I have about the finest situation in this respect that any man could ever hope for.

A Few Examples

Every transaction between a purchaser and a vender should be on a basis of mutual profit, benefit and satisfaction. Otherwise, sooner or later one or the other will be a loser. The best purchase work can be done on a basis of complete confidence. Three things must be considered: First, the quality of the article to be obtained to best fit the need. Second, the consideration generally covered by the misused word "service," which the vender will give to the purchaser's need. Third, price.

As an example, I am at the present time buying a certain commodity running into many thousands of dollars. Every possible consideration is given to me from the standpoint of providing the proper quality and the vender has gone to extremes in trying to meet our needs. The consideration given to our requirements by way of shipment, etc., is without criticism. But the price, he frankly states, is way below his costs, and we are quite sure that this is true. Still, we buy, though in the usual meaning it is an unethical situation. However, it happens to be a very special case, because this concern is shipping its product to myself and others at a loss, and in doing so is following an established policy. But he is fighting for the establishment of a certain principle of business conduct, and if he wins we will win in the long run. And while at the moment it is an unethical transaction as most men will view it and we are reaping the benefit of what he claims to be too low a price, there will come a time when we will be asked to, and should, work with him to help equalize the situation. As a purchasing agent I believe I owe that man a definite responsibility, if I accept the situation which he offers now, to go through with him to the end.

You emphasize the fact that we are now in a buyers' market and have compared activities of purchasing agents now to comparable activities of salesmen when there is a sales market. But even in a buyers' market such as we now have a large part of the trouble, I firmly believe, is caused by the producing agencies themselves, a weakness which you have designated as "lack of price courage." For instance, a few months ago I had a special piece of apparatus to buy. It had to be made up. I asked for bids, and then one day the executive of one of the companies came in to see me. Recognizing the extreme pressure and competition which was on, I told this man that before I asked for my file of prices, which I had not checked through, I wanted to know whether or not he had given me what he considered an equitable price and the best which he had to offer, because I did not propose to "horse trade" with him. I wanted each man whom I had asked to bid to be given an equal opportunity at the business, and the fact that this man sat at my desk would have no bearing whatever on the final decision. He thereupon informed me that he had not quoted the best price, that he could reduce the quotation $300 and still make a profit for himself. Being thus assured, I was given the papers from my file, checked them and found that he was the only man who could furnish the material and the only one who had quoted.

I felt that, having his assurance that his revised price was legitimate and carried a profit, I was not unethical in accepting it. And he never knew that he had bid himself out of $300. This is a concrete example of what you term "lack of price courage."

In the small matter of printing, a few months ago I asked for bids of exact specifications, quoting the weight, watermark, size of paper, style of type and quantity. The seven bids ranged in price from $14.50 to $107 for this lot. I had been accused by this crowd of being a "price hound," and on that basis would have paid $14.50 and gloated at the other fellow's discomfiture when he found out his loss. The high man, I knew, was unreasonable, and so I paid $67, and was assured that the man who furnished the goods was satisfied with the transaction and made a profit.

Still another case: A vender quoted me a certain price. It was one of the strongest buyers' markets that I have ever known, but I quickly realized that he was using me to get the last cent possible without being frank about the situation. In fact, he used many clubs and sticks, took much unfair advantage of our situation, pulled all the wires possible to make me pay a high price on a low steel market and finally, absolutely by his own activities, drove himself to the point where he sold me the equipment for $10,000 less than he originally bid.

In a contract which I am at present negotiating on a

large scale for service in our entire territory a nationally known vender with whom I have had many years of well-established contact and from whom I have received very special consideration has in this instance, I now learn, adopted a definite policy of trying subterfuge. The contract submitted carried two or three "jokers," which he acknowledged as having been intentional on his part. He has thus chosen to jeopardize a confidence which we had built up with each other over a period of probably twenty years. What should a purchasing agent do in a case of that kind? There is only one answer.

Still another case: A concern with which, for very special reasons, I desired to place a particular piece of business deliberately added a 3 per cent unnecessary profit. Its representatives talked much and did little, but when—without mentioning the amount which it had added, but with which I was perfectly familiar—I said that we would not pay them the price which they had quoted, they immediately said, "We will take off the 3 per cent."

What to Do

These are some of the faults perpetuated by venders. Again, however, the purchasing agents are to blame, as I see it, through failure to take advantage of their own opportunities. As an example: For some three years one of my assistants has been experimenting with a certain particular system of order writing. As the work has grown, it was necessary either to find ways and means to reduce the cost of writing orders or put on extra people. He developed a very simple and very economical method, and a few days ago the representative of the manufacturing company told us of this young man's activities and that the results which he had obtained by working so closely with it had opened up for his concern an entirely new field of endeavor. It was a work with purchasing departments which the company had never suspected could exist, and it is going out now to cash in on that. This is simply and solely the result of the work in this purchasing department by a young man who had enough interest to study his job. This vender in showing his appreciation of this kind of co-operation stated that usually the purchasing agent he or his people called on refused to work with them, sent them to many other departments and so lost the value which might have accrued to them and the credit which would come in a constructive piece of work of this kind.

Well, what should be done to help the general situation? I think I have answered this question in the beginning. But to emphasize a bit:

(a) Executives should not give a purchasing agent a title without the responsibility.

(b) The man so selected should exemplify all that is best in business ethics in his association with the sales departments of other companies.

(c) Sales managers should insist that before they contact with a company their salesmen become intimately acquainted with the routine therein. This will eliminate much misunderstanding.

(d) Manufacturers and organizations of purchasing men should co-operate to meet this problem on a constructive basis with a real determination to eliminate the present misunderstanding. It can be done! And I hope to start the work through the auspices of the National Association of Purchasing Agents.

High-Pressure Pipe Line Fabricated by Electric Welding

A 45-MILE, high-pressure oil pipe line fabricated entirely by electric welding and running from Lamkin to Hodge, La., has recently been completed. The welding was performed under the direction of B. K. Smith of the Big Three Welding & Equipment Company, Houston, Tex.

Oxyacetylene welding was originally applied to such service with excellent results, but estimates indicated that electrically welded joints could be produced at a lower cost. The lowest bid for welding this line by the oxyacetylene method was $2.75 per joint and the bid submitted for electric arc welding was $1.25 per joint. The latter price was considered fair by the Big Three Welding & Equipment Company and in practice proved satisfactory.

The country over which the line runs is rugged and broken. There are hills, deep ravines, woodlands and swamps. There is a river to cross. Despite these physical obstacles the line was laid without difficulty. A total of five gas-engine-driven "Stable-Arc" welders, manufactured by the Lincoln Electric Company, Cleveland, Ohio, were used. In doing the work in the field the welders, of course, operated as a team; that is, four men simultaneously welded four consecutive joints and moved on. The lengths thus formed were joined together by a bell hole operator.

Portable welding equipment used in pipe line construction and electrically welded pipe line before laying in trench

The line was built in 5-mile stages, each stage being finished and tested under hydrostatic or gas pressure before further pipe was laid. The joints were all made in two layers, and with this construction, which was developed by Mr. Smith of the welding company, only fourteen pinholes occurred in 11,000 joints.

Shortly after the completion of construction and before the trench was filled a northwesterly storm swept Louisiana and the temperature dropped to six above zero. It had always been the belief of pipe line men that line built during warm weather would break if left exposed to bitter cold of a winter blizzard. In the past, with mechanically fabricated lines, the belief may have been justified, but the new arc-welded line showed no sign of rupture upon exposure to the lowest temperature that Louisiana has known in 30 years.

Benefits of Standard Specifications

Desirability of enlarging N.E.L.A. guides into complete purchase specifications is pointed out. A broader engineering outlook is needed

By James D. Winans
Public Service Production Company

SPECIFICATION standardization is one phase of the general subject of standardization which has been receiving a good deal of consideration from the industry and is discussed at every committee meeting in one form or another. Some of the greatest minds of the industry have been concentrated in the last twelve-month on the selection of suitable voltage ratings. Many of the things that have been said as regards voltage standardization might well have been applied to specification standardization. The formulation of complete purchasing specifications for electrical apparatus and equipment may be classed as the pièce de résistance of standardization.

If one is permitted to put words into the mouths of F. C. Hanker and H. R. Summerhayes, and to imagine what they might have said at the 1927 winter convention of the A.I.E.E., one has only to substitute specification standardization for voltage standardization to obtain the following: "The lack of a logical and co-ordinated standardization of electrical apparatus extending from the initial supply to the utilization devices has resulted in an unnecessary expense to the industry. Specification standardization up to this time has been largely a matter of individual efforts on segregated types of apparatus. There has been a considerable tendency for the users of apparatus to buy equipment of special nature to suit their own particular conditions. Since these conditions would naturally vary somewhat from operator to operator, the special apparatus ordered by them does not constitute a new but unofficial line of standards but a truly special line of apparatus for each operating company.

"Considerable attention has been given to this tendency to deviate from the established standards recognized by the A.I.E.E., N.E.L.A. and N.E.M.A., since although the use of special apparatus might be advantageous from the point of view of the individual operator, it nevertheless places a burden on the industry as a whole, including those purchasers who believe they are being supplied with special apparatus at standard price. Users of standard apparatus help to bear this as well as the users of special apparatus, since the development costs and extra supervision and manufacturing costs caused by the production of specials tend to raise the cost of standard apparatus. The special tools often required for the production of specials also raise the investment in manufacturing plant, and this extra cost is usually borne by the standard as well as the special product. Furthermore, special apparatus entails longer deliveries, both on the initial apparatus and on renewal and repair parts."

R. E. Argersinger in speaking on voltage standardization at the 1927 winter convention of the A.I.E.E. also might well have used the words specification standardization instead of voltage standardization and thus would have said: "Specification standardization is of value to the consumer principally in two ways: First, that equipment may be used under a variety of operating conditions, and, second, that it may be obtained more quickly and at less cost. If the first result can be secured the electrical manufacturer's production problems should be so simplified that the second would follow readily. It should be remembered that in discussing the possibility of securing apparatus at lower prices by standardization comparisons should be based on the cost of equipment actually purchased at present rather than on the cost of the present standard equipment, since it appears that less that half the major equipment purchased is standard.

Present Standards Not Followed

"The present standards have not been closely followed because, first, the operating companies in general have given too little consideration to simplifying their requirements, and, second, in designing for standardization the manufacturers have placed too much emphasis on cost reduction and have paid too little attention to flexibility of use."

The manufacturers' viewpoint on specification standardization was presented before the electrical apparatus committee of the National Electric Light Association at Pittsburgh on May 3, 1927, by T. J. Pace of the Westinghouse Electric & Manufacturing Company when he said: "If the utility engineers realized what these special orders mean to the manufacturer and the purchaser alike, in the way of cost and delay, compared to an order for something that had been built before and which often

would serve the purpose about as well, they surely would be glad to lend their help. It doesn't solve the problem to buy the special thing at the standard price, for that only transfers the burden. The industry, in the final analysis, must assume it just the same. It may surprise you to know that 75 per cent of our orders for power apparatus call for special features of design. It means several million dollars a year, and it would be worth while if it always brought forth improvements. But we feel rather strongly that a good deal of this expense might be saved if the industry would adopt more nearly common standards. What we need is the opportunity to do some manufacturing instead of building so many things to order. Our business at present is too tailor-like, and we all know the difference in cost between a tailor-made garment and a stock garment."

Work to Be Done

Specification standardization, or any near approach thereto, can be accomplished only by the adoption of standard forms for requests, for quotations and for contracts and by the education of the industry to the point where orders cover equipment manufactured "in accordance with Standard Specification No. A, with the following exceptions," and may these exceptions be the exception and not the rule. J. C. Parker, in the May 29, 1926, issue of the Electrical World pointed out that it is the essence of any standard that it must be an expression, not of the will of a narrow majority, but of the preponderating thought and feeling of substantially an entire group. Is it not possible for the N.E.L.A., representing, as it does, both the purchaser and the vender, to prepare and sponsor standard specifications that will be acceptable to and adopted by all but the bitter-enders?

It is not to be inferred that every point at issue could easily be settled or that it would be desirable to cover some of these even if agreements could be reached. Examples of the lines along which work might most readily progress are the relation of speeds to capacities of rotating machinery and nameplate data on transformers, voltage regulators, rotating machinery, relays, etc.

Even the field of voltage standardization has not been completely harvested, for not only have the tentative proposals to be more generally accepted, but the tap voltages, which for a great many ratios of transformation cannot be settled merely by the specifying of a percentage within certain limits if satisfactory paralleling is to be obtained, must be prescribed in some such manner as is outlined in the recent article on the power-transformer situation by F. W. Gay and J. D. Winans in the March 12, 1927, issue of the Electrical World. It has been demonstrated as necessary to tabulate an approved list of secondary turns and corresponding primary full-winding and tap turns for transformers in the so-called power or substation class, and extension of the principle has already been made to transformers for use with synchronous converters.

In considering a piece of apparatus as well established and commonly used as the power transformer, it may be well again, to quote from Mr. Pace, speaking from the manufacturers' viewpoint, when he said: "We furnish somewhat in excess of 2,000 of them a year. We are able to manufacture for stock less than 5 per cent of that number. We cannot escape the endless combination of primary and secondary voltages, the different types, self-cooled, water-cooled, air-blast, etc., not to mention mounting and other requirements for different conditions."

Another important line of product which Mr. Pace used as an illustration is the industrial motor, in the case of which he stated that the Westinghouse company has standardized on 22,000 different machines, but still has its business nearly 50 per cent "special." We cannot blame the manufacturers if they feel a bit disheartened under the circumstances.

It would, it is true, be hard to point out the line of demarcation between such standard specifications and the A.I.E.E. standards. Possibly there should be no difference, the present rules being incorporated in the new specifications, in which case, of course, the duty of preparation and presentation to the A.E.S.C. would devolve upon the A.I.E.E., or at least upon a joint committee of the N.E.L.A. and the A.I.E.E.

L. W. W. Morrow in the May 21, 1927, issue of the Electrical World pointed out the chaotic conditions existing at the present time in regard to standardization as a result of overlapping jurisdiction and non-co-operative effort on the part of organizations which are as the sands of the sea in number. It would seem better to have the proposed director of standards occupy some such position as executive manager of the American Engineering Standards Committee.

N.E.L.A. Specification Guides as a Basis

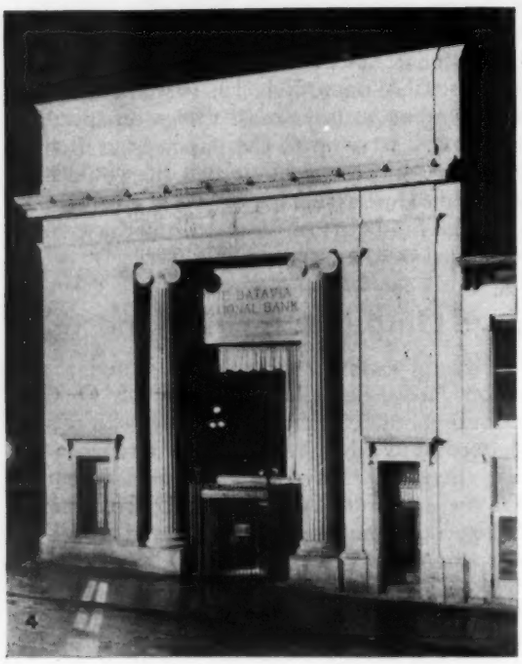
By means of serial reports of the electrical apparatus committee of the N.E.L.A., some sixteen so-called guides for specifications have been presented to the industry in the last year or so, each "intended to serve as a reminder of the points which may be necessary in a specification and as an indication of the logical order in which they should be enumerated." The proposition is then that some group in the electrical industry set out to make a standard, a purchase standard for all apparatus and equipment, by amplifying these guides until they become purchase specifications completely covering, in conjunction with the A.I.E.E. standards, the manufacturing and testing of electrical apparatus and equipment from the viewpoint of the purchaser; not the viewpoint of the purchaser in the narrow sense, as opposed to the best interests of the manufacturers, but in the wider sense, as covering the points in which the purchaser is chiefly interested, and leaving to the manufacturers the greatest flexibility in design in order not to stifle progress.

C. F. Hirshfeld, in an address before the public-utility group of the National Association of Purchasing Agents (see the Electrical World, Feb. 12, 1927), states that the wise purchasing agent buys most things on specifications of some sort. It is up to the engineer to furnish these specifications, and certain it is that he would have a much easier time justifying his requirements if they were based for the most part on standard purchase specifications recognized by the industry as a whole.

Large Output in Switzerland

ACCORDING to a report recently presented to the Association Suisse des Electriciens by M. O. Ganguiller, the output of electric generating stations in Switzerland, excluding that from plants having a capacity of less than 1,000 kw., amounted last year to 3,515,000,000 kw.-hr. from run-of-river hydro stations, 439,500,000 kw.-hr. from storage plants and 1,700,000 kw.-hr. from steam stations; 20,500,000 kw.-hr. were "imported" from adjoining countries, giving a total of 3,976,700,000 kw.-hr. This figure does not include the output from state plants serving the Federal Railways.

Civic Attractiveness at Night Obtained by Floodlighting



No. 1. Effective illumination of Soldiers' Monument at Highland Park with two 250-watt units.

No. 2. Wrigley Building, Chicago. Floodlighting has a definite financial value here.

No. 3. Soldiers' Field Colonnade, Chicago. Lighted with twelve 1,000-watt units.

No. 4. Bank building floodlighted with two 500-watt units.

No. 5. An interesting old landmark in Mount Emblem Masonic Cemetery made conspicuous for miles around by use of sixteen 500-watt projectors.

Fields for Floodlighting

Night illumination of parks, beaches and athletic fields increases their value to public. Floodlighting of private buildings a profitable investment. Fields of application

By A. H. SMITH

Illuminating Engineer Public Service Company of Northern Illinois, Chicago

SEVERAL years ago when a building in Chicago was first illuminated a humorous-minded newspaper reporter wrote a facetious story in which he estimated the number of sticks of chewing gum represented by the bill for electricity. At that time the nightly expenditure of about $60 for illumination was generally regarded more as a publicity stunt than as a sound business expenditure.

Since that time, however, interest in architectural floodlighting has become so widespread and its development so rapid that today there is hardly a city of importance in the country without examples of floodlighted buildings, and leading architects are incorporating in the design of their buildings special features and adequate provision for the effective use of light as a means of architectural embellishment.

FLOODLIGHTING LENGTHENS THE DAY

Moreover, floodlighting is finding an increasing application not only in the lighting of outdoor spaces, such as parks, beaches, athletic fields and other public places, but in the fields of industry as well it is being used to illuminate night work so that 24-hour operation can be carried on with maximum efficiency. Railroad yards, construction work, quarries, docks and outdoor operations such as oil field or refinery work and the like can now be so efficiently floodlighted that hardly any slowing down of work is necessary due to darkness.

For that reason some consideration of the sales factors that influence the use of floodlights and a brief outline of the equipment and methods used in up-to-date installations are of interest to the public utility concerned with supplying the energy for operation.

Floodlight illumination of buildings falls into two general classes—public buildings or monuments and private structures. The chief factor governing the use of light on public monuments and buildings is, of course, civic pride. The use of abundant light in making a public place or monument attractive is just as effective when it is used to draw crowds to a civic community house as it is when used to draw crowds to a theater. People at night time instinctively tend to congregate in a brightly lighted spot, and the brilliant illumination of a public building or monument is one of the simplest and most logical means of increasing its effectiveness and extending its usefulness. With modern methods of city planning and the recognized importance of focusing the city's life around certain definite civic centers, the use of floodlighting becomes one of the most certain and most economical methods of drawing the community's life to the desired points.

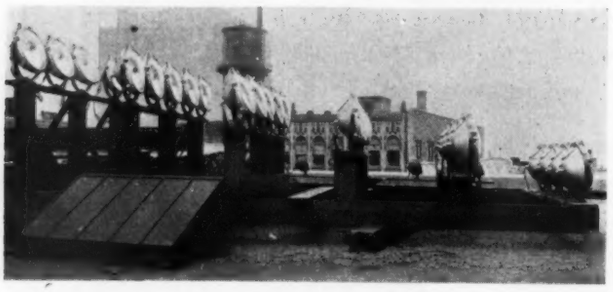
In the floodlighting of areas other than buildings the same reasons that lead to the use of floodlights on buildings and monuments are applicable to public parks, beaches, playgrounds, athletic fields, etc.—namely, civic pride and increased usefulness. There is little doubt that the factory worker and the city dweller in general favor daylight saving time schemes because they permit an extension of recreational activities into the hours after work. Floodlighting public recreational facilities serves exactly this same end and accomplishes it without the annoyance of manipulation of the clock.

Standard tower for mounting floodlighting projectors

When a community properly illuminates its bathing beaches, its athletic fields or its playgrounds, the result is the same in a way as opening up additional beaches or building increased playground facilities. There is perhaps no cheaper and easier way of quickly providing increased recreational facilities than by this means. Attendance figures in instances where public recreational facilities have been adequately illuminated show that a comparatively small expenditure of this kind will make these facilities available to thousands of persons who might otherwise seldom be able to use them. When the total amount of money involved in the construction and the maintenance of public parks and playgrounds is taken

into consideration, the expenditure required for adequate illumination is a comparatively trifling sum. And getting the maximum use out of a plant or an investment is just as sound business in the case of a public institution as it is in the case of a private one.

In addition to the fact that floodlighting increases the usefulness of public facilities, one of the prime considerations is the added safety that proper illumination assures. This is particularly true of bathing beaches, and the safety factor is of almost equal importance in any



One bank of thirty 1,000-watt projectors on the Wrigley Building, Chicago

large open space where people congregate in large numbers. The value of good illumination as an aid to adequate police surveillance is, of course, too obvious to need pointing out.

Nowadays a municipal stadium is certainly not complete without adequate provision for night illumination. One outstanding example of the increased effectiveness of a stadium made possible by night lighting is that of the Soldiers and Sailors Field at Chicago. During the outdoor season this great public institution is almost as effectively operated after dark as during the daylight hours. Recognizing the necessity of night lighting from the start, the design of the field was planned with this idea in mind and provisions were made for an effective floodlight installation. Properly designed platforms and columns that support the necessary floodlight projectors are an architectural part of the structure itself.

The result is that large religious gatherings such as the great Eucharistic Congress of 1926 and events such as the Chicago Rodeo, etc., are as effectively held after sundown as by the light of day. Although the Chicago installation is a large one involving the use of approximately a hundred 1,000-watt projectors, the cost of its installation and operation is insignificant compared with the public benefits derived.

In the field of private institutions, efficient floodlighting of a building can in many cases have a definite financial value. It may not have been anticipated in the case of the Wrigley Building that the nightly illumination would be of value in keeping rental space filled with tenants. And yet that was one of the most striking results.

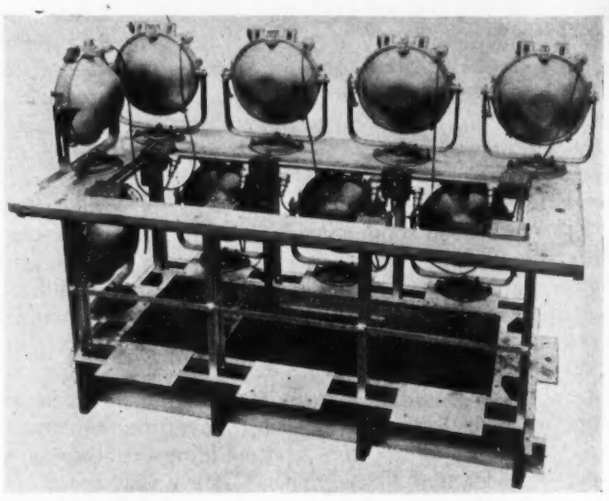
A recent article in *Building Investment and Maintenance,* devoted to the interests of building management, says:

"One of the principal things being sold by the owners of office building space, whether the building is occupied principally by one company or whether it is divided up among a large number of individual tenants, is a well-known address. Tenants buy this feature of established location, and particularly in the case of a new building is it necessary to get the building known quickly. No other method does this job so quickly and so satisfactorily as floodlighting of a building where there are any striking features worthy of the lighting. The cost of the floodlighting comes back in quicker rental, sometimes in a higher rental scale, and certainly in satisfaction to the tenants."

Another effective use of floodlighting is found in the increasing practice of real estate companies and builders of illuminating newly constructed homes as a means of advertising them. Although the temporary nature of installations of this kind does not make it particularly desirable business for a public utility, it has been found that such installations are an effective means of stimulating interest in the possibilities of floodlighting and frequently pave the way for large permanent installations for other uses.

The industrial uses of floodlighting over large outdoor areas cover an extraordinarily wide range. The use of floodlights to enable construction operation to continue at night is having an increasingly wide application. The value of adequate light in speeding up any kind of work is none the less effective because a workman is employed outdoors rather than at a bench. In addition, the insurance value of adequate general lighting in the prevention of theft and tampering where machinery and material must be left outdoors is an important item.

Although floodlight installations on construction work may be of minor interest to the public utility, due to their temporary nature, the value of other industrial uses is easily recognizable. There are few factory establishments with extensive open storage yards that are not legitimate prospects for floodlighting installations. The value of such lighting equipment where the factory is likely to be operated at night is obvious. Driveways, loading platforms, storage piles and the like are perhaps



Tower basket with capacity for eighteen projectors

It is designed for permanence with a view to easy maintenance and safety. Conduit is an integral part of the basket and entrance is through a trapdoor in the floor.

more effectively lighted by this method than by any other. Particularly in the case of lumber yards, coal yards and similar areas where the theft of material is a constant hazard the use of floodlights is one of the most effective means of prevention.

Some of the most important installations of floodlights for the illumination of extremely large areas is to be found in the recently adopted practice of several railroads to illuminate their switching and storage yards

by this method. Since switching operations must be carried on at night as well as by day and since a railroad yard usually represents a sizable piece of property, the illumination of these large areas has been until recently extremely difficult. It is constantly necessary for switchmen to be able to recognize the numbers and designations of freight cars while they are in motion, and carefully planned floodlighting has made this possible in every instance. As might be expected, the job of a switchman in a dark yard filled with moving trains is a highly hazardous occupation, hence floodlighting is an important advance from the standpoint of safety. One of the notable recent installations of this kind is that which was made in the Wabash Railroad's classification yards in Chicago.

Since the development of floodlighting has taken place only within the past few years and since the best equipment is nearly all of comparatively recent design a brief review of the general principles involved and a description of the most successful types of equipment are important. Primarily the development of the high-wattage Mazda lamp has made possible present-day development of floodlighting projectors. These lamps have supplied the illuminating engineer with a source of light of great volume and high efficiency that can be operated effectively throughout the life of the lamp. Using these lamps as a basis, it has been the attempt of the illuminating engineer and far-sighted manufacturers to develop projectors that afforded maximum projection for the light flux emitted.

Although illumination can be obtained by simply disposing high-powered light sources at various points and equipping them with the conventional type of open reflectors, the results obtained by this method cannot compare either in brightness or in efficiency, much less in installation cost, with a method that assures maximum control of the light by placing the lamp in a scientifically designed projector, which projects the greater portion of the light rays into a single beam and, by the use of properly designed optical lenses, diffuses and focuses the rays effectively over the area to be illuminated.

For example, a Chicago advertising company recently desired to illuminate a large sign covering almost the entire side of a fifteen-story building on Michigan Avenue, and extreme brightness was desired. The preliminary estimates involving a certain type of projector indicated that approximately 4.5 watts per square foot would be required. Upon a revision of the estimate, however, by an illuminating engineer, it was found that by the use of eight 1,000-watt projectors equipped with rectangular divergence lenses that would refract the rays of light and distribute the illumination evenly over the entire area it was possible to get an even brighter illumination than had been contemplated with only a little more than 1 watt per square foot. It is evident that the use of properly designed equipment improves results and minimizes current costs, thereby increasing greatly the number of available prospects by getting current requirements down within reason.

The application of properly designed reflectors equipped with carefully designed optical lenses for control of the beam makes possible the illumination of comparatively large areas with a very small number of units of high wattage. As a general rule it has been found that a smaller number of large projectors of great capacity give much more satisfactory results than a large number of smaller units. Certainly it simplifies the problem of installation and maintenance and at the same time permits the illumination of many areas that could not be lighted with small units except at prohibitive expense.

Construction work at night made possible and safe through floodlighting

The economical use of units of high capacity may be said to have been made possible by the development of suitable lenses so that adequate control could be had over the distribution of light. The parabolic reflector with which the projector is equipped serves to concentrate the light, but has the disadvantage of projecting simply an image of the filament. Where the beam is to be thrown across long distances and concentrated as much as possible within a small area, there is sufficient diffusion of the filament image so that a lens is not needed and the best results follow the use of a clear cover glass made for the door of the projector.

However, in case the projector is intended to illuminate larger areas or areas of rectangular shape, other means must be provided for diffusing and distributing the light over the desired area without too great loss of efficiency. As a means of getting efficient distribution

and an even spread of light the best practice now is to use suitable lenses in the door of the projector. The simplest form is a door of stippled glass, which scatters the light. The efficiency of this sort of diffusion is very low, however, and has resulted in the development of optically correct lenses that gather the light, confine it entirely to the desired area and effect a perfectly uniform distribution without filament images or streaks. A complete range of such lenses has been developed and their proper use enables some distinct economies in the amount of light needed and at the same time assures perfectly even distribution.

A so-called rectangular diffusion lens has been developed that projects a rectangular-shaped beam in which all the light is concentrated and which cuts off sharply at the edges so that none is wasted and so that one beam may be placed alongside another without streaks and dark patches where they overlap. Other types of lenses effect what is called circular diffusion over a 45 deg. arc and replace the wasteful stippled glass door where a broad area is to be illuminated close at hand by one or more high-power projectors.

The earlier types of projectors for the most part made use of silvered-metal reflectors similar to those used in automobile headlights. The superior efficiency of the silvered-glass reflector, however, has led to its adoption in the better designs, the best practice being to place the silvering on the side of the reflector away from the lamp.

The earlier types of large-capacity projectors were practically all of the ventilating type. That is, in order to carry away the considerable amount of lamp heat it was necessary to circulate air through the lamp for ventilation. This practice had the disadvantage that dust and smoke were deposited on the inside of the lamp so that the efficiency of the projector was soon impaired by dirty reflectors and lamps, making frequent cleaning necessary.

Severe corrosion of the heated metal parts was likely to be set up by the circulating air and breakage of lamps and reflectors was excessive due to the fact that particles or even drops of water were often carried into the projector by the air stream and deposited on the heated lamp or reflector. It became necessary to evolve a non-ventilating type of projector so designed that the heat of the lamp was carried away by radiation rather than by direct ventilation.

Some manufacturers are now producing non-ventilating projectors that are entirely airtight, thus keeping all smoke, dirt and moisture out of the inside of the projector and eliminating all necessity for maintenance or opening except for lamp renewal. Practically the only maintenance necessary on good equipment now is a periodical washing of the outside face of the projector in order to remove the smoke and dirt deposit.

Another point of importance is the construction of projectors from materials that will not corrode due to the action of smoke and gases. This is particularly true in the cases of installations in railroad yards and industrial districts. The use of bronze and aluminum throughout is the best sort of economy.

Projectors are also fitted with suitable focusing devices and with mountings that permit a permanent setting of the direction in which the projector is pointed and yet permit it to be released so that it can be turned into convenient position for cleaning and then returned to the same fixed, permanent adjustment.

Night view of Wabash classification yards, Chicago

When the projector is intended for the illumination of ground surfaces, it is well to place it as high above the ground as practical, on buildings, water tanks or steel towers that have been developed for this special purpose in a standardized form that reduces the cost considerably.

When the projector is used for illumination of signs or wall areas, it should be placed below the eye level if possible or at such an angle that the angular reflection of the beam is not directly at the observer.

The methods of disposing projectors for the illumination of large areas such as railroad and factory yards, quarries, storeyards, etc., is well illustrated in the recently installed floodlight system used for the Wabash Railroad classification yards at Chicago. Lighting this yard, which is almost a mile in length, involved the lighting of an area of more than one and a quarter million square feet of tracks, one-third of which comprised the ladder tracks, requiring an illumination to the intensity of 0.145 lumen per square foot, whereas the remaining two-thirds, comprising storage tracks, called for an intensity of 0.073 lumen per square foot. This was accomplished by the use of fourteen standard 1,000-watt projectors, which were divided among three 100-ft. standardized floodlighting towers. Where beams of wide di-

vergence were required to illuminate the areas close to the towers, the projectors were fitted with 45 deg. circular divergence lenses; on the longer throws clear lenses of heat-resisting glass were used. One tower was located approximately at each end of the yard and the third tower was placed in the center of the yard so that the projectors cast light in both directions.

The towers used in the Wabash yards are of a standardized design evolved especially for floodlighting work by the engineers of the American Bridge Company and the Pyle-National floodlighting engineers. The towers are completely fitted with integral electrical fittings, and it is interesting to note that they are assembled on the ground on this particular installation and raised into position in less than ten minutes, the entire installation of the floodlighting system being installed in a few days' time.

Electricity Consumption on the Farm

By Frank D. Paine

Supervisor Iowa Project on Rural Electrification, Garner, Iowa

FROM records of the rural electrification project at Garner, Iowa, there is presented here an analysis of the consumption of electricity for various uses on a dairy farm of 195 acres. In the home there were used in one year 816 kw.-hr., according to the tabulation:

	Kilowatt-Hours		Kilowatt-Hours
Lights	360	Water supply	245
Washing machine	65	Radio	100
Iron	40	Vacuum sweeper	6

The above uses are listed in the order of their preference by the wife of the farmer. She would like to add to the list a refrigerator and an ironer, which would use 550 kw.-hr. and 72 kw.-hr., respectively.

The consumptions in the farmstead were as follows:

	Kilowatt-Hours
Building lights	120
Milking machine (24 cows)	540
Separator	54

These farm uses of electricity are not extensive. Grinding oats and barley would easily add 320 kw.-hr. Ensilage cutting, corn grinding and grain elevating could be done electrically, too.

The actual use of electricity on this farm in one year was 1,548 kw.-hr. To get a complete idea of how much energy this farm might easily use, there must be added to this figure the consumptions of the refrigerator, ironer and feed grinder that are next on the list for purchase. This makes the annual consumption rise to 2,472 kw.-hr.

Another case—a stock farm of 320 acres. Actual consumption was:

In the Home:	Kilowatt-Hours Per Year	On the Farm:	Kilowatt-Hours Per Year
Lights	372	Building lights	120
Water supply (for both hard and soft water)	49	Milking machine	212
Washing machine	22	Separator	38
Iron	38	Elevating grain (7,000 bu.)	64
Refrigerator	365	Corn shelling (1,000 bu.)	40
Radio with battery charger	64	Sawing wood	20
		Incubator	300
		Feed grinding	400

Business Allocation at Cambridge, Mass.

AN INTERESTING exhibit of the Cambridge Electric Light Company in the recent rate case before the Massachusetts Department of Public Utilities presented the ratios of different classes of business handled by the company in 1926 to total business, as given in the accompanying table. This company serves a diversified industrial and residential community with a population of about 150,000 (including Belmont, which is supplied at wholesale). Its gross electric revenue in 1926 was $2,024,377, its total operating expenses $1,367,835 and the present value of its property on the reproduction cost basis was computed at $8,035,469. The total sales of energy were 53,675,929 kw.-hr., of which 14,115,232 kw.-hr. was for metered lighting, 34,576,077 kw.-hr. for power, 1,823,183 kw.-hr. for municipal arc and incandescent lighting, 260,262 kw.-hr. domestic power sales and 2,901,175 kw.-hr. sales to other companies.

CLASS CHARACTERISTICS IN PER CENT OF TOTAL 1926 BUSINESS CAMBRIDGE ELECTRIC LIGHT COMPANY

Class	Demand Responsibility	Kw.-Hr. at Buses	No. of Customers—Average During Year	No. of Customers—Average End of Year
Residence lighting	23.25	12.32	79.94	80.40
Commercial lighting	18.37	12.36	14.33	13.75
Refrigeration and cooking	0.87	0.73	1.48	1.82
Primary lighting	10.39	7.27	0.01	0.01
Power	44.72	64.09	4.24	4.02
Street lighting	2.40	3.23	.....	.....
Totals	100.00	100.00	100.00	100.00

It is seen that while the kilowatt-hours for lighting are about equally divided between residential and commercial, the demand responsibility of the former is more than one-fourth (26 per cent) greater than that of the latter, in itself justifying a higher unit price for residential use, since the delivery of 1 kw.-hr. ties up more equipment. Further, less than half the demand responsibility falls on the power load (44.72 per cent), while nearly two-thirds of the output goes to it. Here again the proportionate share of plant is much smaller than the proportionate share of load.

Returns also show a much smaller relative demand responsibility, and therefore a smaller proportionate share of investment per kilowatt-hour for refrigeration and cooking than for lighting, definitely justifying a separate and much reduced rate for refrigeration and ranges, though it should, from the data, average higher than the rate for big power.

Electric Pumping Service for Oil Pipe Line

AN OIL pipe line about 400 miles long from the West Texas fields to Cushing, Okla., is now being laid by the Shell Pipe Line Company, according to a paper presented at the Oklahoma Utilities Association convention by O. A. Jennings. The line, of 10-in. pipe, will contain fourteen pumping stations, all electrically driven and supplied with energy from the systems of the Oklahoma Gas & Electric Company, the Southwestern Light & Power Company, the Texas Power & Light Company and the West Texas Utility Company. Each station will contain three 400-hp., 2,200-volt motors direct connected to centrifugal pumps. Two units in each station will be in

normal operation, the third being held for stand-by. The annual load factor of this business will be about 90 per cent according to preliminary estimates and surveys of operating factors for such service.

This installation will be one of the first completely electrified pipe lines in the country. The decision of the Shell Pipe Line Company to use electric drive throughout was made after careful comparison of electricity with other forms of power. The principal virtue of the use of electric power is the lower initial cost, about one-third less than steam or oil. The need for only one attendant per station reduces labor charges. Repairs, maintenance and depreciation are much less. Centrifugal pumps, which on account of their high operating speeds are best driven by electric motors, possess peculiar advantages over reciprocating pumps for pipe lines. If the line becomes plugged the pressure will not exceed a predetermined definite amount, which may be provided for in the design of the line. If any pump stops it does not constitute a complete obstruction because the oil, under pressure from the other pumps, can continue to flow through it. These considerations, and others, decided the Shell Pipe Line Company to go to all-electric operation of the new line.

Letters from Our Readers

Economical Installation of Wiring

To the Editor of the ELECTRICAL WORLD:

The subject of more economical wiring installations has had considerable discussion by the N.E.L.A. wiring section and jointly with other associations. It appears to lead to one conclusion, namely, that a more suitable design of conductor is desired. This thought has brought about a number of methods and materials which their advocates claim substantially reduce the expense of installing wires. Today we have advocates for concentric conductors, non-metallic sheathed cable with all wires insulated and also with one wire bare, and flexible steel conduit with one bare wire and those that demand both wires insulated, as in the past. Also the old favorite knob and tube method, which will always have many advocates. It is a fair question to ask if any of these methods, made into a standard, will relieve the cost of installing wiring or of making extensions to a sufficient degree to warrant all this effort, with also the possibility of some new material being designed to replace all or some of the existing materials?

Another item of considerable moment, which also pertains or rather is related to this subject, is the automatic protection of circuits. Favorable action will no doubt be taken soon on some design adaptable for recognition and inclusion in the code. The present activities concentrate on branch circuits, but this should be carried through to as large capacities as the type will permit. Such acceptance will give advantages to the entire industry and offer many economies that will be difficult to obtain through any other medium.

Regardless of the style of wires, we are compelled to utilize two, and very little is to be gained by reducing the quality of the insulation, considering the possible hazard involved. It might be policy to permit the grounding or solid wire to remain in its present insulated condition and place a better quality of covering on the outside wire and allow these to be run under the present rules for non-metallic cable. This has the advantage of allowing the installation of switches without requiring a loop system. This system has some advantages, but they are more than offset by the additional cost.

Many central-station companies, to combat the evil of overfusing and bridging of circuits, have required that the main service fuses be sealed. Several of these concerns have stated that with the acceptance of a type of fuse and cutout or other means to prevent this abuse they will gladly discontinue sealing the main fuses, thereby eliminating one type of equipment that is causing a large amount of the present-day expense of installing wires, namely, the carrying of many duplicate styles of merchandise for the same purpose. Some few years ago we had the condition of 37 or 38 attachment plugs and out of the confusion a satisfactory standard was adopted with benefit to all concerned. The situation is similar to the practice in vogue on safety switches. One jobber carries fifteen different types, while any one of them would answer the need for a proper disconnect means. Such circumstances should be corrected before a great deal of stress is placed upon the necessity for a more economical conductor.

Another feature for reducing the cost of construction in this class of building would be for some organization to group together all the possible tools and a list of the manufacturers and try to improve or redesign, with the view of providing a quicker method to facilitate the workmen in their problems, and more particularly relating to finished house extensions. The field offers an opportunity for the inventive minds of the artisan as well as the executive. Some action to promote interest in such a proceeding should bring about improvements of a decided nature. Anything that can reduce the labor expense will offer greater possibilities than a small reduction in material costs of conductors. Without question this would increase consumption through the added convenience of installing additional outlets. The labor item on this class of buildings is considerably in excess of material costs. The experience of all trades in reducing the labor required for a given task is satisfactory proof that a larger amount of business can be expected through any effort of a concerted nature to lower this item.

The rule calling for twelve outlets on a circuit may now be omitted, under certain conditions. This has probable advantages, but it should not be encouraged until such a time as the rules recognize a type of fuse that cannot be overfused or easily bridged. When this condition arrives—and it should at an early date—the requirements for twelve outlets on a branch circuit can be dropped from the code, and allow, perhaps, any number of outlets, as circumstances warrant, with a possible floor-area limitation. Such a condition appears to the minds of many as the ideal arrangement and would constitute one of the most economical means for reducing the outlay for new work and extensions in old buildings.

If the various interested organizations would combine and employ a field secretary and instruct him to tabulate all such information and work in conjunction with any cause along these lines a probable benefit would accrue to every branch of the industry. A great deal of improvement could be accomplished through such proceedings to the welfare and betterment of the fraternity.

C. W. COWLES.

23 Lakeview Avenue,
New Britain, Conn.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Pulverized Fuel at Derby. — The results of the first eight months of operation of a pulverized fuel plant at the Derbyshire Corporation station are summarized in this article. The equipment used is outlined and the economies and operating conditions involved are offered for average conditions. The mills are of the Raymond type and pulverization is effected by rollers running in contact with a steel ring.—*Electricity* (*England*), March 15, 1928.

Electricity and Fuel Conservation.—W. T. TOWNEND.—The economic considerations involved in the generation of electricity and the combustion of coal have been reviewed by the author with particular reference to the generation of electrical energy in plants producing coke, and at mine-mouth operations. The discussion refers particularly to the possibilities in Great Britain and because of the local factors involved is particularly applicable to that country.—*Electrical Review* (*England*), March 30, 1928.

Transmission, Substations and Distribution

Load-Ratio Control Transformers.—M. CORNUDET. — Transformers with voltage taps, and an electro-mechanical arrangement for the change of these taps without load interruption, will, according to the author, give an apparatus which is less expensive than an induction voltage regulator or a synchronous converter. They are, in addition, applicable to high voltages, while the regulator and the converter cannot be built safely for more than 6,600 volts. A Swedish concern has developed such a transformer tap-switching arrangement or load-ratio control for voltages up to 77 kv. and 350 amp. The apparatus is built in three types, suitable for 10,000, 33,000 and 77,000 volts, but the basic principle is essentially the same for all. When changing from one tap to the next the step is first prepared by closing an auxiliary contactor, which establishes a current by-pass over an ohmic resistance, then the main tap contact is moved to the next position, whereupon the by-pass is opened again. Since the whole cycle takes but two seconds the load current flows through the resistor only for a very short period. During this transient period, when stopping of the mechanism would burn out the resistor, a warning signal is given. A three-phase transformer with five regulating positions requires seven contactors per phase, or a total of 21 switches, which are mounted in three switch tanks, suitable for outdoor use. A great number of transformer connection diagrams are given, to show the use of such equipment for various applications, such as power transformation, regulating transformers and tie-in transformers.—*Bulletin de la Société Française des Electriciens*, Vol. 77, 1928.

Systematically Sectionalizing Primary Circuits.—VERNON W. PALEN. — The practices developed as a result of many years' experience with the sectionalizing of primary circuits is offered by the author in this exposition of suggested procedures. The discussion centers largely around operating and test methods of particular interest to operating men. It is stated that in sectionalizing primary circuits to lessen trouble and restore service to all consumers at the earliest possible moment one company has found it advisable to avoid manipulation of potheads whenever possible and to arrange sectionalizing so as to restore the service furnished to consumers who, due to size of establishment or nature of work, will be the most handicapped by a prolonged shutdown. On single-feed circuits it is suggested that the tests be carried out after underground cable is tested from the end of the primary nearest the substation, picking up the load of each tested section from the outside primary coil. On single-loop circuits with the open loop at the center the procedure for testing from the center of the loop to substation, taking up load at each testing section, is advocated. On double-loop circuits a similar procedure is advised, since each individual loop of a double-loop circuit has its own circuit breakers and disconnecting switches, and, therefore, is held to be independent and may be treated as a single loop. — *Electrical Times* (*Australia*), Feb. 27, 1928.

Generation, Control, Switching and Protection

The Static Balancing of Rotors.—B. P. HAIGH.—The balancing of rotors for electric machines involves, according to the author, two fundamental methods, the theoretical and the practical. While the theoretical principles have long been firmly established on the basis of Newton's laws of motion and probably no longer admit of any important development, the practical art of balancing is said to change from year to year and to vary according to the character of the rotor and the requirements of the circumstances under which it will be used. The various conditions of unbalance, that is, static, dynamic, internal and their combinations, are discussed by the author in connection with mathematical expressions for the significant factors. The subject of the critical speed has received particular attention in this first of several articles. The ratio between the two critical speeds, the secondary or dynamic and primary or static, has been expressed in connection with this consideration.—*Engineer* (*England*), March 23, 1928.

Units, Measurements and Instruments

The Thermal and Electrical Conductivity of Some Aluminum Alloys and Bronzes.—EZER GRIFFITHS and F. H. SCHOFIELD.—The primary object of the investigation undertaken by the authors was to obtain approximate values for the thermal conductivities of alloys employed in the construction of aero-engines. The measurement of the electrical conductivity of the alloys was undertaken to throw light upon its relation to the thermal conductivity. For this purpose an accuracy of 1 per cent was assumed to be sufficient. The method used consisted in a comparison of the drop of potential across a measured length of the specimen with that across a standard resistance arranged in series with it, when a steady current of the order of 20 amp. was passed through the two. Two thermocouples of copper-constantan were pegged into the specimen, serving not only to measure the temperature but as potential leads for resistance measurement. By appropriate switch arrangements the thermocouple wires were arranged to be rapidly altered so as to serve either purpose as required. As any temperature difference between the two ends of the bar would give rise to a thermal electromotive force, when measuring the potential difference across the bar, readings of the latter were obtained for the two directions of the current, so that by taking the mean of these values the effect of the thermal electromotive force was eliminated. In determining the resistivity the usual procedure was to take measurements on a series of rising temperatures and to repeat the process until a steady state had been reached.—*Engineering* (*England*), March 9, 1928.

Illumination

A New Art in Electric Lighting.—W. E. BUSH.—The comparatively recent development of the use in lighting practice of sheet glass fixtures—that is, fixtures concealed behind glass panels—and of other modern innovations in the lighting art are reviewed by the author. It is stated that one feature of the new lighting practices is the tendency, and in some cases the necessity, for planning by the architects to co-ordinate the scheme and the details of installation with the design of the building. This is particularly the case when glass panels must be installed flush with the walls, ceiling columns, etc. It is anticipated that such equipment will become

one of the major features of importance in the design of homes and other buildings of the future. A factor in the new lighting which commends itself to illuminating engineers is the possibility of obtaining a high intensity of illumination with a low surface brightness of the lighting equipment. This is due to the much greater area of glass that is used than if ordinary fittings were employed and, secondly, it is generally necessary to use a number of the medium-sized lamps instead of a smaller number of large lamps. In either case, however, it is neccessary that a liberal allowance be made for a total wattage if pleasing results are to be obtained. The need for investigation by illuminating engineers upon this subject in order that a high degree of efficiency may be made possible by the use of reflectors and careful selection of a glass which combines good light diffusion with low absorption is pointed out.—*Electrician (England)*, March 30, 1928.

Motors and Control

The "Electromersible" Pump. — A specially designed centrifugal pump driven by an electric motor has recently been developed as a single unit. The machine consists of a three-phase squirrel-cage motor combined with a centrifugal pump the rotor of which runs in the water. The stator core and the windings are protected with a watertight, non-corroding inclosure which is filled with transformer oil. The oil forms a good cooling medium and also prevents condensation of the atmospheric moisture in the winding inclosure. In this device the water enters the suction at one end of the motor and passes through an annular space in the rotor which is joined to the impeller. The shaft therefore runs freely between the two end bearings without requiring any glands and the leakage water around the periphery of the impeller fills up the space around the stator winding inclosure and is drawn into the suction again at the running clearance of the rotor at the opposite end, thereby forming a very efficient cooling circulation when the motor is working above water. The oil- and water-tight inclosure is of a special alloy and is entirely stationary. Such devices have been manufactured for an output of 100 tons per hour against a 75-ft. head and are said to operate equally well above water as when submerged under 40 ft.—*Electrical Review (England)*, March 30, 1928.

Electrophysics, Electrochemistry and Batteries

Electrolysis and Its Mitigation. — W. B. BUCHANAN.—The author has reviewed the general problems involved in the prevention of electrolytic destruction of water pipes and other metallic conductors located under ground, has analyzed the effects of stray currents and of electrolysis conditions and offers a survey procedure for the elimination of the difficulties. The necessity for good conductivity in the joints of pipe lines is particularly emphasized, as it is stated that if the potential drop across the joint due to the flow of stray direct current is a fraction of a volt, part of this current will be shunted by the soil which is in contact with the adjacent ends of the two pipes. The amount of current, of course, depends on the electrical resistance of the soil as well as the difference in potential, but any tendency whatever in shunting of current in this manner is hazardous and should be avoided. The meters and measurements which may be utilized in analyzing the conditions covering electrolysis are mentioned as important, even though great precision in the measurement of current is not attainable. — *Electrical News (Canada)*, March 15, 1928.

Heat Applications and Material Handling

Resistance Welding Machines.—A. HILPERT.—During the last ten years metal industries have adopted electric resistance welding to a wide extent, since the joining of straight or round pieces to produce either a mechanical or a tight connection can be accomplished more quickly and cheaply than by riveting or folding. This article gives an extensive description of modern welding machines of European manufacture, covering butt-welders, spot-welders, seam-spot welders, continuous seam welders, rivet heaters and electric forges. Depending upon the cross-sections to be joined, butt-welders have a hand-operated, motor-driven or hydraulic compressing device. Spot-welders are frequently combined with a current-limiting device to prevent excess current demand and overheating. Seam welders are found useful for steel up to $\frac{5}{16}$ in. thickness. An interesting example of a double seam welder is shown for steel barrels, joining both heads simultaneously. All of these machines have transformers with adjustable winding ratio to accommodate the secondary current to the thickness of the welded piece. The present tendency of rivet heaters is toward air cooling, to avoid inconveniences and the possibility of freezing attendant upon water cooling.—*Zeitschrift des Vereines Deutscher Ingenieure*, March 3, 1928.

Traction

Suburban Railway Electrification.—A description of the equipment and design of the suburban section of the Bombay, Baroda and Central India Railway. It is stated that as railway services under steam operating conditions proved unequal to the task of transporting the rapidly increasing number of suburban residents on the line, electrification was planned and carried out. Among the interesting features of this equipment are: Trains consist of unit equipment—that is, driving trailer coach, motor coach; the control equipments are capable of operating three four-coach units—that is a twelve-coach train accommodating 1,500 passengers; the capacity of the existing steam trains being about half this amount, a fully loaded train may be rapidly accelerated and it is possible to attain a speed of 27 m.p.h. within 30 seconds from the initial start; unusual conditions of heavy floods, often causing 2 ft. or more of water on the rails, requires the specification of watertight equipment. Operating factors and economies are considered.—*Electrician (England)*, March 23, 1928.

Telegraphy, Telephony, Radio and Signals

Long-Distance Radio Receiving Measurements. — TOMOZO NAKAI. — It is stated that measurements on radio wave intensity of the order of thousands of microvolts may be made by comparatively simple devices and arrangement, but that to measure quantitatively and accurately such a weak radio field intensity as is of the order of tens or units of microvolts per meter it is necessary to make use of a particular arrangement to which the greatest care should be paid in design, construction and calibration work, otherwise the errors of the measurement may be large. As a result of a scientific and technical investigation of the received radio wave intensity allowing for diurnal and seasonal variations the author undertook the construction of the receiving set unit and local signal oscillator unit with proper shielding devices and in the first discussion has detailed the methods of measurement, arrangement, calibration, accuracy and similar factors of importance.—*No. 217, Researches of the Electrotechnical Laboratory, Japan.*

Miscellaneous

French Tidal Power Schemes.—The construction of tidal power stations forms part of a national scheme which is being carried out in France for the utilization of all available sources of energy with the object of rendering that country as far as possible independent of foreign coal supplies. Plans for tidal power installations along the coast of Brittany and the Channel have already been prepared representing a total of something more than 2,000,000 hp. The scheme receiving greatest consideration in this discussion is that of Defour, which utilizes the relative levels of two basins. In the Defour system the auxiliary basin, which only drives the turbines on a discharge into the sea, takes over the work when the head from the principal basin falls too low. There is thus a fairly regular output during the whole period of the rising and falling tides. This does not provide for peak loads and the problem would seem to be complicated by the tide advancing one hour in twenty-four hours. This makes it difficult to insure a concordance between the energy produced and the load curve. So far as theoretical considerations go, it is stated that the schemes are proving attractive to big electrical and mechanical engineering corporations.—*Engineer (England)*, March 23, 1928.

News of the Industry

Boulder Dam Feasibility in Doubt, Says A.E.C.

Committee of Eminent Engineers Finds Unanimously that Colorado River Development Should Be the Subject of Further Expert Investigation

A SPECIALLY appointed committee has just reported to the American Engineering Council against the acceptance of existing reports as evidence of the engineering feasibility of the Boulder Canyon Dam on the California River which the Swing-Johnson bill, now before Congress, would make it incumbent upon the federal government to build.

The personnel of this committee is of a nature to make its finding carry great weight in the engineering world. The chairman, Francis Lee Stuart, has been chief engineer of both the Erie and the Baltimore & Ohio Railroad and has had part in much important work involving hydraulic construction. In the last few years he has been a consultant in connection with the greater harbor project of Los Angeles, the lake-lowering controversy as it affects Chicago, the regulation of the great lakes, lake-to-gulf transportation and the "giant power" plan of Governor Pinchot. The four other members of the committee are Allen Hazen of New York, an expert on water supply; Clemens Herschel, a former president of the American Society of Civil Engineers and the inventor of the Venturi water meter; J. Waldo Smith, who was chief engineer for the New York Board of Water Supply from 1905 to 1922 and completed the new Croton Dam for that city, and Lewis B. Stillwell, former president of the A.I.E.E. and an outstanding electrical engineer, who has just been elected for the fourth time as chairman of the Engineering Foundation.

The committee's report follows:

The undersigned, constituting the committee appointed by the American Engineering Council to examine the Boulder Dam project from an engineering standpoint and advise the council in regard thereto, respectfully report as follows:

Your committee is unanimously agreed that the information set forth in the reports which have been submitted to us is not conclusive as to the engineering feasibility of the plan outlined in the Swing-Johnson bill, and that before either the government or private capital would be justified on engineering or economic grounds in committing themselves to the expenditure involved the development of the river for the purpose in view should be further and most thoroughly investigated to determine how the results which it seeks to accomplish can be secured with a reasonable assurance of success.

The bill of Senator King of Utah calling for an engineering investigation of the Colorado River situation was summarized in the ELECTRICAL WORLD for April 7 (page 723). On April 11 Representative Douglas of Arizona introduced a bill with a similar motive. It provides that the President shall appoint a board of five engineers of "unquestionable national reputation" who shall "examine into and investigate the Colorado River" and recommend "the most feasible method and cost of obtaining flood control, as to the best systematic program of development." Not more than one appointee shall be or have been in the employ of the Bureau of Reclamation or a resident of any Colorado River Basin state.

The Secretary of War is to build the flood-control structures recommended by this committee, $15,300,000 being appropriated for that purpose, including expenses and salaries of the engineers, but construction shall not begin until the Santa Fe compact shall have been ratified by the seven states and by the Congress, "or until all of said states and the Congress shall have agreed, by compact, that no title to waters, in excess of present perfected rights, which may be stored by such flood-control dam shall be acquired."

Boulder Canyon Debate About to Start in Senate

As this is written the Senate apparently is ready to take up the Boulder Canyon bill. Prophecies are made that the measure will pass, but it will be in the face of determined opposition which will also have an important effect on the attitude of the House.

Notice was served on the rules committee of the House of Representatives on April 18 by the military affairs committee that if a rule for the consideration of its Muscle Shoals bill is not granted, the measure will be called up on May 2, when the committee will have the call of the calendar.

United Engineering Society Seeks Endowment Funds

An endowment of $7,000,000 for the Engineering Foundation and the Engineering Societies library is sought by the board of trustees of the United Engineering Society, representing the national societies of civil, mining and metallurgical, mechanical and electrical engineers. One fund of $5,000,000, it is planned, will be applied to the research projects of the Engineering Foundation and a second fund of $2,000,000 to the maintenance of the library.

Secretary of Commerce Hoover has accepted appointment to the endowment committee, of which Col. Edward A. Simmons is chairman.

Trade Commission Makes Its Second Report

Two Thousand Company Responses to Its Questionnaire Already Filed—So Far Little Beyond Routine Information Has Been Elicited

THUS far in its investigation of the public utilities the Federal Trade Commission has not revealed a single misstatement of fact or any apparent indication on the part of the industries concerned to withhold information sought by the commission. Those who are following the investigation closely are said to be impressed by the fair and businesslike manner in which it has so far been conducted and praise the capacity of Edgar A. McCulloch, the commissioner in immediate charge. The progress which has been made has been facilitated by the ready way in which the utility associations have opened their files and co-operated in every other way.

That the commission has met a ready response to its questionnaire is indicated by the fact that, as made public in its second monthly report to the Senate, two thousand returns already have been filed. In this report the commission announces that additional schedules are being prepared to send to the companies operating in more than one state, to holding companies and to their subsidiary financial, management and construction companies. Special schedules also have been prepared for the municipal utilities. The commission announces that "systematic examination is being made of various sources of information with regard to particular transactions in the electric power and gas industries, in order to develop specific information regarding the growth of capital assets, the methods of issuing securities and other financial matters specifically mentioned in the resolution."

Hearings conducted last week developed only well-known facts. It has been no secret that the utilities have been opposed to the government in business. Full statements of the activities of the Illinois State Committee on Public Utility Information and of the New England Bureau of Public Service and Information were made by B. J. Mullaney, the director of the Illinois committee, who is vice-president of the People's Gas Light & Coke Company and of the American Gas Association; by R. R. McGregor, the assistant director of the Illinois committee, and by Samuel T. McQuarrie of the New England bureau. The testimony brought out that the utilities feel that a public service is being performed in making available the type of information and material handled by such committees, and that it also is necessary to meet unfair attacks and mis-

information put out by those who are hostile to the utilities and toward their operation by private enterprise.

During the week representatives of the newspapers owned and controlled by the Copley Press and by Ira C. Copley were heard. Testimony was to the effect that their editorial policies had in no way been governed by outside influence and that no utility had any hand in financing them.

The commission announces that hearings will be resumed April 24, when officers of the National Electric Light Association and the American Gas Association will reappear, together with representatives of the Joint Committee of National Utility Associations.

Cincinnati Rate Reduction

Union Gas & Electric Ends Litigation by Adoption of Schedule Based on Room Charge—Annual Saving to Consumers of $500,000

NEW rates which will reduce electric light bills at Cincinnati sufficiently to effect a saving of $4,000,000 in seven years have been agreed to by the Union Gas & Electric Company, Cincinnati, according to a company announcement on April 14. "While feeling secure in its position, legal and otherwise," the company says, "in order to avoid long and expensive litigation for itself and the city, and with a desire to maintain cordial relationship with the consumers of electricity," the proposal, said to be acceptable to all members of the City Council, has been made.

The essential difference between the company's offer and the contested ordinance passed last fall is the basis of the rate structure. The minimum charge in the new rate will be based not on the number of outlets but on the number of rooms. Because it will be necessary for the company to check up on the number of rooms in the home of each of its patrons, the new ordinance will not become effective until September at the earliest, the prevailing rate in the meanwhile being continued.

It is estimated that the reduction involves, with the present number of consumers and their average of consumption, a saving of more than $500,000 a year, but it is calculated that the new basis and form of rates will result in a considerable increase of consumption. The new residence rates include a demand charge of 10 cents per room per month for a minimum of four rooms, plus an energy charge of 5 cents per kilowatt-hour for the first 6 kw.-hr. per room per month and 3 cents for all in excess of 6 kw.-hr. The minimum bill will be 75 cents.

It is understood that with the passage of an ordinance accepting this proposal, which had been scheduled for April 18, all litigation will be discontinued. The rates which the municipality sought to enforce last fall had been enjoined in the federal court pending a hearing. The company had won a suit brought by a taxpayer in the Common Pleas Court, and the municipality had appealed.

Power Stations Featured at Baltimore

Regional Meeting of A.I.E.E. Discusses Gould Street Station and Conowingo Development—Dielectrics, Turbo-Generators and Stability Also Among the Topics

MORE than 250 members and guests of the American Institute of Electrical Engineers attended the sessions of the regional meeting held in Baltimore this week.

Electrical insulation and related problems in dielectrics were considered at the opening session on Tuesday. A thermal method of standardizing dielectric power-loss measuring equipment was offered by J. A. Scott in a paper prepared in collaboration with H. W. Bousman and R. R. Benedict. This application involved investigations of dielectric power loss in cables utilizing the sheath temperature rise associated with the flow of heat due to power loss within the sheath. The method avoids the errors involved in the use of a reflecting astatic electrodynamometer wattmeter using an air capacitor for phase-angle compensation.

The practical considerations involved in the application of mica folium to the insulation of coils for high-voltage turbo-generators were pointed out in a paper prepared by C. H. Hill and read by J. L. Henderson.

A further report of determinations regarding the effects and characteristics of residual air and moisture in impregnated paper insulation was made by J. B. Whitehead, W. B. Kouwenhoven and F. Hamburger, Jr., in a paper read by the latter. Discussion ranged largely around this paper, it being contended in general that investigations involving a specially prepared short-length, non-reeled cable sample gave results widely divergent from those obtainable with standard materials and that methods applied here would be inapplicable to production manufacturing. This assumption was discounted by several members, who discerned a tangible advantage in the investigation of basic phenomena under favorable, controlled conditions. Dr. Whitehead disclaimed any attempt to simulate commercial manufacturing conditions in this laboratory work.

A lecture, "Sounds That Burn," was delivered by Dr. R. W. Wood on Tuesday evening, and following this the two regional prizes for the best paper and the best first paper of 1927 were both presented to Sigmund K. Waldorf for his exposition of a new amplifier to adopt the oscillograph to low-current investigations.

The new Gould Street generating station of the Consolidated Gas, Electric Light & Power Company was the subject of the Wednesday sessions. A general description of the features of this plant was presented by A. S. Loizeaux. The design studies which preceded the erection of the first section of the station and the engineering considerations leading to the specification of major items of equipment were detailed by F. T. Leilich. A. L. Penniman, Jr., and F. W. Quarles outlined the problems and experiences encountered in the operation of this station. As this was the first pulverized-fuel installation on the Baltimore company's system the operating personnel was carefully selected. A frank statement of early operating difficulties was made.

The Gould Street plant has several unusual features, including one boiler for each turbo-generator unit, condensers with rolled tubes at both ends, and bleeder heaters utilizing hairpin-loop, single-tube sheet construction. Water-cooled furnace walls are installed. The cost for the ultimate station of 160,000 kw. was given as $79 per kilowatt and the thermal performance obtained is 14,000 to 15,000 B.t.u. per kilowatt-hour.

Prof. A. G. Christie discussed the paper, dwelling on the points just referred to, and pointed out that the use of one boiler to one turbine made the boiler house shorter than the turbine house.

H. C. Sutton said the 450-lb. steam pressure permitted an interesting comparison with present-design plans for the Deepwater station on the Delaware opposite Wilmington, where only 1,380-lb. boiler pressure will be used. L. W. W. Morrow pointed to the unusually large use of automatic control in the plant and especially on the alternating-current auxiliaries, where wide speed ranges were desired.

A. L. Penniman said the station had come up to the expectations of the designers. Heavy maintenance on the pulverized-coal installation was required at first; the heat transfer in air heaters did not come up to expectations; radiation losses were larger than expected, but so was boiler-heat transfer. He said that lessons learned for building a new station were: (1) Do not start up a pulverized-fuel plant in winter. (2) Use 800-deg. to 825-deg. F. steam temperature. (3) Dry all pulverized coal in the preparation mill. It had been shown, he asserted, that all metal-wall furnaces would operate splendidly at very high ratings.

An inspection trip to Gould Street station was made on Wednesday afternoon and a dinner-dance was held that evening. Herbert A. Wagner, president of the Consolidated Gas, Electric Light & Power Company, was the speaker at the dinner. He paid tribute to the engineer and the work he had done to make possible modern life. President Bancroft Gherardi also spoke briefly.

The Conowingo development was covered in three papers presented on Thursday morning, and a large party was booked for an inspection trip there on Friday. On Thursday afternoon system stability and overexcitation were to be discussed, and, in addition, a paper on the communication features of the Conowingo project was scheduled.

Argument in New Jersey Merger Suit

Attorney for Public Service Corporation Maintains that the Public Good Should Take Precedence Over Stockholders' Rights Where These Conflict

ARGUMENT was heard at Newark, N. J., last week before Vice Chancellor Baker in the suit brought by minority stockholders against the merging of five leased companies into the Public Service Electric & Gas Company of New Jersey. As previously reported (ELECTRICAL WORLD, July 2, 1927, page 34), the underlying companies involved are the Essex & Hudson Gas Company, the Paterson & Passaic Gas & Electric Company, the New Brunswick Light, Heat & Power Company and the Somerset, Union & Middlesex Lighting Company. The Public Service Corporation in bringing about this consolidation followed its settled policy of simplifying its organization and capital structure.

Robert H. McCarter, attorney for the Public Service Corporation, argued that the mergers were of benefit to the public and enabled the corporation to borrow money at a lower rate of interest than can be obtained where leased properties are concerned. He challenged the right of any stockholder to seek to prevent a business movement for the public good because the stockholder has an investment in a leased company.

Thomas G. Haight, counsel for the minority stockholders, argued that the merger would relieve the Public Service Corporation from paying rentals on the 900-year leases and that, since Public Service stock would receive dividends only when earned, the stockholders in the absorbed companies would be deprived of their right to an assured return. Mr. Haight maintained also that the market value of the stock of the leased utilities was less a measure of value than the equity behind this stock.

Mr. McCarter asserted that a majority of stockholders in the leased companies favored the merger plan and that only a catastrophe could affect the 6 per cent dividends of the Public Service stock. If such a catastrophe occurred, the leases would have to be canceled anyhow, he declared.

A decision on the case is expected in the near future.

Electrical Men Meet with Oil Burner Makers

The fifth annual convention and exposition of the American Oil Burner Association, held at the Hotel Stevens, Chicago, on April 3, 4 and 5, brought together 1,500 representatives of the greatest variety of interests ever assembled to discuss the problems of oil heating, including many electrical men. The convention demonstrated that the oil-burner industry is impressing the value of its products upon the electrical industry.

A particularly pertinent address was given by Charles K. Nichols of the New York Edison Company, who spoke of the increased attention which electric light and power companies are giving to the possibilities of oil heating. "There is a great chance," he said, "for the oil-heating industry and the electric light and power central stations to help each other out." Mr. Nichols went on to say that his industry, through the National Electric Light Association and the Association of Edison Illuminating Companies, is investigating oil heating and, if satisfied with the information developed, is preparing to promote the use of domestic oil burners just as it is now pushing electric refrigerators. This interest is due to the desire to equalize the central-station "load."

The fact that the Board of Underwriters has placed its stamp of approval upon a large majority of representative oil burners now in use was cited as proof that the industry no longer need fear opposition to its products on the ground of danger from the burning of oil in domestic heaters. Government statistics were quoted to prove that oil prices today are practically the same as in 1913.

Plans Forwarded for Chicago Industrial Museum

Impetus has been added to the plans for the Chicago Industrial Museum by the appointment as director of Waldemar Kaempffert, science and engineering editor of the New York *Times*, who will pass several months studying similar museums in Paris, London, Vienna and Munich before taking up his new work.

The Chicago Industrial Museum, which will have 400,000 sq.ft. of floor area — or about the extent that Sir Henry Lyons, director of the Science Museum of South Kensington, London, regards as ideal—has been made possible by a gift of $3,000,000 from Julius Rosenwald in addition to $5,000,000 appropriated by the South Park Commissioners to reconstruct for this use the fine arts building of the World's Fair of 1893. Mr. Kaempffert emphasizes the intention to make the museum more than a heterogeneous collection of machines. It is to be an educational institution for the presentation of scientific and engineering principles.

Miami Draws 600 Men from Southeast

Divisional Convention Discusses Merchandising, Rural Service and Other Industry Topics—Invited Speakers Give Outside Points of View

THE Southeastern Division of the National Electric Light Association, comprising North and South Carolina, Georgia, Florida, Tennessee and Alabama, as well as Porto Rico and Cuba, held its sixteenth annual convention on April 11 to 13, at the Roney Plaza Hotel, Miami Beach, Fla. The registration exceeded 600 and many guests of national prominence were present. From every standpoint the convention was one of the most successful in the history of the division.

After President Joe H. Gill had reviewed the year's divisional activities and H. T. Sands, president of the National Electric Light Association, had once more pressed home the duty of service and the need of eliminating public misunderstanding concerning the aims and methods of the industry, John M. Hager, director of market surveys, Domestic Commerce Division of the United States Department of Commerce, addressed the opening meeting on "Government Survey of Industry and Trade in the Southeast." Mr. Hager stated that the South has stepped ahead of the nation in growth since 1914, the South's increase being 307 per cent as compared with an average of 250 per cent in other sections of the country. Harrison Jones, executive vice-president Coca Cola Company, then gave a stimulating talk on merchandising that was well received. Mr. Jones said that 50 per cent of electric appliances were sold by the customers of the utility rather than the salesmen as the customer knows more about them than the salesman. He said that individuals get in the frame of mind to buy from reading advertisements and hearing what other people say about the appliances and that therefore the service of the appliances already sold was an important factor in sales work.

Comprehensive committee reports filled the sessions of Wednesday afternoon. The speech of Dr. J. S. Thomas, director of extension of the University of Alabama, who addressed a joint meeting of the Commercial and Accounting Sections on Thursday, was one of the best at the convention. Dr. Thomas dealt with the importance to culture of modern business methods and inventions. C. E. Greenwood, director of commercial activities at N.E.L.A. headquarters, and E. A. Davis, chairman of the Accounting National Section, also addressed this joint meeting, at which it was resolved to formulate plans looking toward accounting methods which would reflect merchandising costs in a better way.

Major H. S. Bennion, director of engineering of the N.E.L.A., at the Engineering Section meeting outlined what is being accomplished in the co-ordination of communication systems with the power transmission and distribution lines.

At the second general session, on Thursday, John F. Owens, chairman of the Public Relations National Section, spoke on the functions of that section and the chairmen of the Public Relations, Commercial, Engineering and Accounting Sections of the division gave

reports, all of which brought forth considerable discussion. An impromptu speaking contest conducted by the women's committee was won by Miss Edith Wise of the Knoxville (Tenn.) Power & Light Company, to whom a free trip to the coming Atlantic City convention of the national association was awarded.

A feature of the third general session was the talk of Phillips B. Shaw, vice-president of the National Electric Power Company, on the operation of the merchandise department in relation to other phases of utility operation. Mr. Shaw thought that since utility companies are pushing their merchandising programs the greatest need is to educate the major executives into regarding merchandise activities as something which can be coordinated with the rest of the operations rather than carried on apart from them. He spoke in favor of the district representative methods of operation whereby such representative does service as well as sales work. Another speaker was Miss Eloise Davison, home economics adviser of the N.E.L.A.

Rural electrification was the subject of Forrest D. Banning of the Florida Power & Light Company, who gave an outline of its growth in the Southeast and told about the 120,000-acre small-farm development in Florida of J. C. Penny, where 90 per cent of the farmers are using electricity.

A feature of the entertainment program not common at N.E.L.A. conventions and much enjoyed was the deep-sea fishing. The following officers were elected for the coming year: President, Charles A. Collier, vice-president Georgia Power Company; first vice-president, Stuart Cooper, vice-president South Carolina Power Company; second vice-president, T. H. Tutwiler, president Memphis Power & Light Company; third vice-president, H. E. Cox, Birmingham Electric Company.

Bay State Lower House May Ask Utility Inquiry

The postponement until next year's session of the bill asked by the Massachusetts Department of Public Utilities to govern rate regulation has not yet been agreed to by the House of Representatives, although the Senate, as reported on April 7 (page 723), adopted the joint legislative committee's report recommending this policy. In the House a substitute resolution was referred to the committee on ways and means, from which at the time of writing it had not been reported.

This substitute resolution provides that an unpaid special commission, consisting of one member of the Senate to be designated by the president thereof, three members of the House of Representatives to be designated by the Speaker, the chairman of the Commissioners of the Department of Public Utilities and two persons to be appointed by the Governor, "shall investigate ways and means for regulating the rates, valuations and capital issues of gas and electric companies in such manner as will be fair alike to the public and to the companies concerned," including the recommendations of the Governor and the department now before the Legislature. This special commission would be instructed to report to the Legislature not later than Dec. 1, 1928, with the drafts of recommended legislation.

Cooper Applies Again

Hydro-Electric Engineer Asks Federal Power Commission for Columbia River Permit—Porto Rico Company Seeks License—Storage in National Forests

HUGH L. COOPER has applied again for a preliminary permit covering a project in "Z" Canyon on Clark's Fork of the Columbia River near the Canadian boundary. The Federal Power Commission, in April of last year, rejected an application from him for a preliminary permit because of the doubt of obtaining state rights and because of the lack of potential market. The objection of the state, which was based upon possible interference of this project with development of the Columbia Basin, has been removed (ELECTRICAL WORLD, March 3, page 474), and Colonel Cooper advises that he is now in a position to demonstrate his ability to market the power. About 200,000 hp. of primary power is available at the site, and it is planned eventually to install 350,000 hp. Favorable reports have been submitted by the Forest Service and the Bureau of Reclamation with the usual provisos, and it is understood that a favorable report has been submitted to the War Department.

The Porto Rico Railway, Light & Power Company of San Juan has applied to the Federal Power Commission for a license covering a project intended to develop the power resources of the Blanco, Hicaco, Cubuy, Sabana, Prieto and Sojonto Rivers. This company previously had been denied a preliminary permit, owing to the fact that it was in conflict with an application submitted by A. L. Arpin and because neither applicant at that time had been granted territorial rights. In the meantime the light and power company has completed its surveys and has acquired the necessary franchise in Porto Rico. It is planned to construct a 1,200-acre-foot storage reservoir on the Hicaco into which the waters of the Sojonto and Prieto Rivers will be diverted. A power house will be constructed 1½ miles below the dam. Another dam will be built just below the power house, where another reservoir will be created to impound the waters of the Sabana and Cubuy Rivers. Another power house will be built 2 miles below that dam. It is planned to install 10,000 hp. The project is of particular importance in Porto Rico, where fuel is high.

Action having an important bearing on the rights of water-power licensees who plan to develop storage in national forests has been taken by the Federal Power Commission. In at least one important case private owners of lands lower down the river obtained an injunction against such storage on the ground that a reduction in flood heights affects injuriously the productivity of certain downstream lands enriched by overflow. The commission finds in that case, which affects the San Joaquin River developments of the Southern California Edison Company and the San Joaquin Light & Power Corporation, that these projects are desirable and justified in the public interest for the purpose of improving navigation. Recently this relation to navigation was investigated. It was found that the storage would aid navigation by the reduction of flood flows and by the increase in the low-water flow.

Adjourn Royal Gorge Hearing Until May 2

Another hearing by the utilities commission of Colorado on the application of the Public Service Company of Colorado to build a hydro-electric plant in the Royal Gorge near Canon City was held at Pueblo on April 12, when Warden Richard Shaw of the State Reformatory, Mayor Alexander and other representatives of Salida, Colo., Chief Engineer Arthur Ridgway of the Denver & Rio Grande Western Railroad, Franklin P. Wood, consulting engineer, Denver, and others opposed the application. Hearing was adjourned to May 2, when testimony in rebuttal will be heard.

Court Allows Six-Cent Rate at Worcester

Residential and commercial customers of the Worcester (Mass.) Electric Light Company are now being billed at a maximum net rate of 6 cents per kilowatt-hour on meter readings dating from April 1. Judges Bingham, Johnson and Lowell issued a decree last week in the United States District Court at Boston modifying the injunction against the Massachusetts Department of Public Utilities prohibiting the commission from enforcing its decision of last June ordering the company to reduce its maximum rate from 7 to 5 cents per kilowatt-hour. The injunction was modified to permit the company to charge a 6-cent rate as a result of a voluntary reduction from 7 cents recently announced by the utility.

Counsel for the commission and the company agreed upon the modification pending final determination in the federal courts of the propriety of the commission's 5-cent rate. The court finding requires the company to deposit a million-dollar bond for refunds to its customers in case it loses its case and allows the company to charge a 7-cent rate on bills remaining unpaid fifteen days after rendering. On the reproduction-cost-less-depreciation rate-base method the company maintained its right to a return on $17,837,965, while the commission set the maximum base at $10,000,000.

St. Lawrence Notes Are Made Public

Kellogg and Massey Arrive at "Acceptable Basis of Negotiation" for Waterway and Power Development—United States to Pay for International Section of River

FOUR notes on the projected St. Lawrence River waterway exchanged since January by Secretary of State Kellogg and Vincent Massey, the Canadian Minister at Washington, have been made public there and at Ottawa. These notes are formal and in part repetitious of standpoints already taken by the American and Canadian governments. An "acceptable basis of negotiations" is defined in them as follows:

"That the prosecution of the improvement of the St. Lawrence waterway be based on the undertaking by the United States of the deepening of the necessary channels through the interconnecting waters of the Great Lakes and the improvement of the international section of the St. Lawrence both for navigation and for power, and the undertaking by Canada of the construction of the waterway in the sections wholly Canadian, that is, the Welland Canal and the works in the St. Lawrence below the international boundary."

No serious dissent on the part of Secretary Kellogg was made to a contention by the Canadians that the United States bear the somewhat larger portion of the cost of the work still to be done. The Ottawa government, in addition, declared that further consideration was necessary on its part as to some engineering phases of the problem, while other details, for constitutional reasons, required decisions by the Dominion Supreme Court in cases now pending. Mr. Massey asserted, nevertheless, that it was agreed the project was "feasible."

As for hydro-electric power, Canada made clear that "such power as may be rendered available on the St. Lawrence, whether from the wholly Canadian section or from the Canadian half of the international section, shall be utilized within the Dominion to stimulate Canadian industry and develop the national resources." It also declared that "the development of power on the Canadian side should not exceed the capacity of the Canadian market to absorb it."

To this Secretary Kellogg replied that "it would seem that the United States ought to be permitted to develop its power and use its half, the other half to be used by Canada or not as it should desire. The United States," he added, "fully recognizes the right of the Dominion of Canada to the ownership and use of the Canadian share of the power which may be developed in the international section of the waterway, as well as to all that developed in the national section, and it recognizes also that the disposition of the power is purely a domestic question. It recognizes further that this share is an inherent attribute of Canadian sovereignty, irrespective of the agency by which the power may be developed." Elsewhere the Secretary said that the United States "regards as acceptable the proposal that the design and operation of works in the international section of the river be under joint technical control and assumes that the design of all works on the waterway will comply in general with the plans agreed upon by the Joint Engineering Board as embodying the best principles."

A tentative expense table submitted by the Canadian government put the total cost of canalization and ultimate power development (3,148,900 hp.) at $400,830,000 for Canada and $383,183,000 for the United States. The figures for Canada include $85,560,000 representing the existing St. Lawrence and Welland Canals and Sault Ste. Marie Lock.

Addressing the Canadian Parliament, Premier King intimated his sympathy with the project and expressed the view that it was an undertaking bound to be carried out at some time in the course of North American development. It was the first intimation Parliament had had of the Premier's personal attitude with respect to the proposed enterprise.

Purchases and Mergers

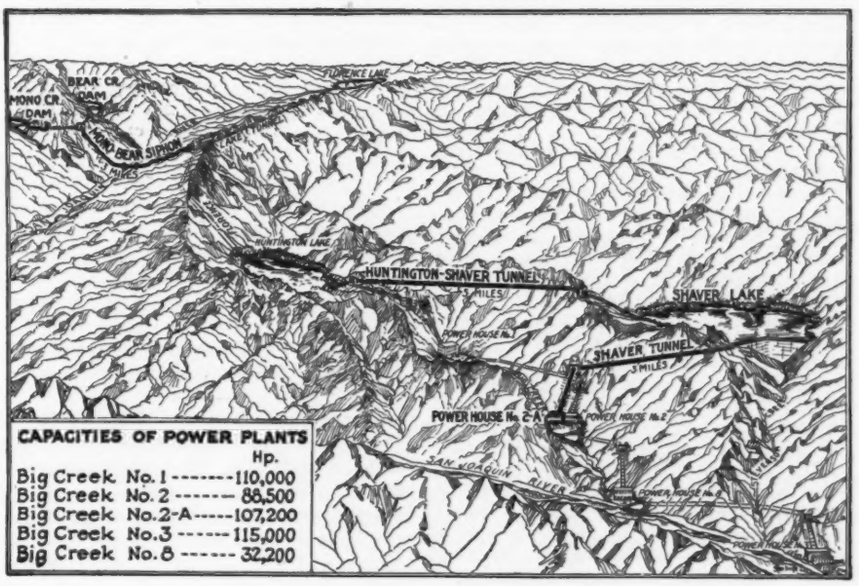
Penn-Ohio Edison Preparing to Take Control of Northern Ohio Power—Scituate (R. I.) and Corsicana (Tex.) Properties Are Sold

CONSOLIDATION, long awaited, of the Penn-Ohio Edison Company and the Northern Ohio Power Company began to shape itself into a reality last week when the directors of the former company voted to approve of an exchange of securities of both companies, which exchange will eventually give the Penn-Ohio Edison control of the Northern Ohio Power. A notice calling Penn-Ohio stockholders to a special meeting May 1, at which time formal approval of the transaction will be sought, will be mailed shortly. The Penn-Ohio Edison Company, incorporated in Delaware, has among its subsidiaries the Penn-Ohio Power & Light of Youngstown, the Ohio River Edison Company of Youngstown, the Grand River Electric Light & Power Company of Rock Creek, Ohio; the Zelienople (Pa.) Light &

Southern California Edison's Advance

Appropriations for 1928 Include Nearly $6,000,000 Each for Big Creek, for Long Beach and for Transmission-Line Extensions and Substations

INFORMATION from the Southern California Edison Company says that its Long Beach steam plant No. 3 is well advanced and that the first 93,750-kw. unit will be ready for operation about July 1. Foundations for another unit of the same rating are being laid, and the machine has been ordered. Eventually the plant may have eight units and a million horsepower. Construction work on Big Creek power house No. 2A is actively under way, and it will be ready for operation by midsummer. It will contain two turbo-generators with a total rating of 107,200 hp. and will utilize water from Shaver Lake under a drop of 2,419 ft. On account largely of this high head, the penstocks will be of special design and material. An appropriation of $5,982,000 for water-power development and one of $5,987,000 for steam-power development divide the two equally in the 1928 budget, which also provides $3,100,000 for extension and completion of the 220-kv. transmission system and $2,565,000 for betterments to secondary transmission lines and substations.



Sketch map of Big Creek-San Joaquin River Development completed and in progress

Power Company and other concerns. The Northern Ohio Power Company controls the Northern Ohio Traction & Light Company of Akron. Hodenpyl, Hardy & Company, to whose group the Northern Ohio belongs; E. W. Clark & Company and Bonbright & Company have agreed to deposit their holdings under the plan of exchange.

Sale of the Scituate (R. I.) Light & Power Company to the Narragansett Electric Lighting Company, negotiations for which had been under way for about a month, was consummated last week. No price was made public. The smaller concern has been obtaining its energy from the larger for some time.

Purchase of the Corsicana (Tex.) Power & Light Company, which controls also the Athens (Tex.) Electric Light & Power Company, by the Texas Power & Light Company is announced.

Permission refused last July (ELECTRICAL WORLD, Aug. 6, page 279) by the Pennsylvania Public Service Commission to the Metropolitan Edison Company of Reading to take over eleven other General Gas & Electric subsidiaries has just been extended.

The plan previously published to consolidate the Buffalo, Niagara & Eastern Power Corporation and its associated companies into one operating company was approved by the directors of the various companies at a meeting in Buffalo on April 13. Chief companies included in the consolidation are the Niagara Falls Power Company, Niagara Electric Service Corporation, Buffalo General Electric Company, Niagara, Lockport & Ontario Power Company and Tonawanda Power Company.

John R. Macomber, a director of the International Paper Company, and his associates have, newspaper reports say, acquired the Northeastern Power Corporation's holdings in the New England Power Association, thus giving the International Paper a preponderating influence over the third large stockholder, Stone & Webster. Details of the transaction were not forthcoming.

Approval of the Missouri Public Service Commission has been given to the purchase of the Kirksville Gas, Heat & Electric Company and the Brookfield Gas & Electric Company by the National Gas & Electric Corporation of Battle Creek, Mich. The National Utility Company of Missouri, a newly formed subsidiary of the National Gas & Electric Company, will operate the properties, and the Kirksville and Brookfield corporations will be dissolved. The price reported was $212,500 for Kirksville and $125,000 for Brookfield.

The Mayor of Little Rock, Ark., has reported an offer of the Arkansas Power & Light Company to purchase the municipal lighting plant. He indicated that he would favor the sale if the company will agree to a substantial reduction in rates.

The City Council of Milton, Fla., has called a special election for May 15 to decide whether Milton shall sell its electric plant to the Gulf Power Company for $65,000 and grant the power company a 20-year franchise. The Council has approved the sale, subject to ratification.

The Canada Northern Power Corporation has commenced the consolidation of its component companies—Northern Canada Power, Northern Ontario Light & Power, Northern Quebec Power Company, Great Northern Power Corporation and the Porcupine Power & Telephone Corporation—by issuance of bonds for $15,000,000.

Briefer News

NEW 50-MILE TRANSMISSION LINE FOR NEBRASKA. — The Iowa-Nebraska Gas & Electric Company plans to build a transmission line from Blue Springs, south of Beatrice, to Humboldt, Neb. The proposed line will pass through Liberty, Burchard and Armour and cover 50 miles. From Humboldt the company plans to extend its lines to Sterling, Stella, Shubert and Verdon. Construction of the lines will cost about $75,000.

ROCHESTER GAS & ELECTRIC INSTALLS TWENTY-SEVENTH SUBSTATION.—Work will be completed early in May on Station 40, the Rochester Gas & Electric Corporation's twenty-seventh main substation, designed to serve the northeast section of the city. The new station is on Ridge Road, where it will relieve Station 1 of part of its burden, and will have a rating of 3,000 kw., Roger De Wolf, assistant superintendent of the utility, says.

LINE FROM GREGGS FALLS TO NASHUA, N. H. TO BE BUILT.—The Public Service Company of New Hampshire will construct a 60,000-volt transmission line from its Greggs Falls station in Goffstown to its station in Nashua, making also a 33,000-volt extension from Hillsboro to Henniker. The line from Goffstown will pass through the towns of Bedford, Merrimac, Litchfield and Hudson. The company already has a trunk line across the state and is now tying in points both north and south.

PUBLIC SERVICE COMPANY OF COLORADO TO ERECT NEW BUSINESS BUILDING.—The Public Service Company of Colorado has taken out a permit to erect a building at West Third and Lipan Streets, Denver, to house nine departments now scattered in various parts of the city as well as to serve as a garage. The new structure will occupy about two and one-half city blocks and cost $500,000. The executive departments will continue to be housed in the Gas and Electric Building.

AMERICAN GAS & ELECTRIC'S BIG PROGRAM. — No less than $40,000,000 will, according to official announcement, be required to carry out the expansion program now under way for the American Gas & Electric Company's subsidiaries, and a large part of this program will be completed this year. In the total sum are included the seventeen-million-dollar extension to the Philo generating station of the Ohio Power Company, where a 165,000-kw. generator with auxiliaries is being installed, and the new twelve-million-dollar Deepwater station in New Jersey, opposite Wilmington, Del., which is jointly owned with the Atlantic City Electric Company. More than $7,000,000 will be spent on major transmission lines, including the connection of the Indiana General Service Company with the main interconnected system of the American Gas & Electric Company; a 132,000-volt line from Philo to Fostoria, a new high-tension line across south New Jersey and other shorter lines. A number of important substations are being built, and $4,000,000, the company announces, will be spent on local distribution lines and customers' services.

DUBLIN (GA.) REJECTS PROPOSAL FOR COMPETITION WITH GEORGIA POWER COMPANY.—The City Council of Dublin, Ga., has refused the application of a number of business men who asked the privilege of operating a co-operative electric lighting plant to supply light to retail stores in the business section. The Council held that the proposal was unfair to the Georgia Power Company, which is operating under a franchise and investing a considerable amount of money in the city and surrounding territory.

EXPANSION IN NEW MEXICO.—The Texas-Louisiana Power Company has begun the construction of an electric power plant at Jal, N. M., and will connect it with its power transmission system by extending the line which runs from its power plant at Pecos to Kermit. The company has also just finished the construction of a transmission line from its Pecos plant to Fort Stockton, 55 miles, and to Toyah, 20 miles. It is supplying several other towns and the oil fields of this section with electric power.

ANOTHER HYDRO PLANT ON THE SHENANDOAH PROJECTED.—The Shenandoah Milling Company of Shenandoah, Va., has obtained options on water rights for a proposed hydro-electric plant on the Shenandoah River, one mile south of Shenandoah. The dam would be approximately 20 ft. in height and 500 ft. long, extending over dry lowland on the east side of the river. The power house would probably be erected on the west side. The milling company recently sold its controlling interest in the Page Power Company's dam at Newport, about 10 miles north of Shenandoah.

DAVIDSON DENIES POLITICAL PARTISANSHIP.—A feature of the Republican primary campaign in Nebraska (referred to last week on page 778) was the appearance of a two-column advertisement signed by J. E. Davidson, general manager of the Nebraska Power Company, who had been accused of supporting Senator Howell, declaring in unequivocal terms that the company was not interested in the candidacy of either the Senator or his opponent and was supporting no one, that it did not belong to any power trust and that no such trust exists in the state.

SECOND CHELAN UNIT TO GO ON LINES ABOUT JULY.—Work is now progressing on the installation of a second 24,000-kw. generating unit in the power station of the Washington Water Power Company at Chelan, Wash. This

second unit will be of General Electric manufacture and identical with the first, which was placed in operation last September. The waterwheel is already in place and the generator is scheduled to go on the line about July 1. Both units are fed through a two-mile tunnel, the dam being half a mile below Lake Chelan on the Chelan River. A second tunnel will be required for the further development of this site.

EIGHTY ADDITIONAL MILES OF TRANSMISSION FOR SOUTHERN MARYLAND.—The Maryland Public Service Commission has granted the Suburban Light & Power Company of Maryland, a newly formed utility, the right to erect 80 miles of transmission lines in three southern Maryland counties, St. Mary's, Charles and Prince George's, to serve a number of communities in that section. The company will purchase its power from the Potomac Electric Power Company of Washington. Decision was reserved on a petition to extend the lines into Calvert County. Such an extension would mean 20 more miles of line.

TABLE ROCK (MO.) HYDRO PROJECT STILL DELAYED.—More delay in construction of the hydro-electric dam at Table Rock, south of Springfield, Mo., where an ultimate expenditure of many millions is projected, was encountered recently, when the Stone County Court rejected a proposal submitted by representatives of the Empire District Electric Company to build five different sections of road, totaling 37 miles, in lieu of a bridge. The Doherty interests, which are back of these schemes, announced that they are ready to begin construction work as soon as the court waives its objection.

MORE PLANS FOR DEVELOPING NOVA SCOTIA'S WATER POWER. — Announcement that a group headed by I. W. Killam of the Royal Securities Corporation, Montreal, will erect a large newsprint mill in Nova Scotia, probably at Liverpool, has been followed by the news that the Nova Scotia government intends, when the plans for the mill project are finally worked out, to undertake hydro-electric development on the Mersey River, part of the power to be purchased by the newsprint plant. The Mersey is capable of developing about 35,000 hp.; of this the newsprint plant will take about 20,000 hp.

KEWANEE A CENTER OF DISTRIBUTION.—The Illinois Power & Light Company within the next 60 days will complete two more of its 132-kv. steel-tower lines connecting with the Kewanee substation, according to S. M. Cox, general manager at Kewanee. The Keokuk connecting line has been in operation a year and the Joliet line approach was being pushed through, with March 1 as the date for the initial electrification of that loop, but erection of a tower at Bureau, on the Illinois River, delayed this work, which will be finished within two or three weeks. The Peoria line will be cut into the Kewanee station within a few weeks. Half the concrete bases have been finished and 30 per cent of the towers erected. A fourth line, from Rock Island, is to be built later, making Kewanee a center point for these four distribution lines.

THIRD UNIT AT HARRAH (OKLA.) PLANT UNDER WAY. — Construction work on the third unit of the Harrah steam-electric station of the Oklahoma Gas & Electric Company near Oklahoma City, which when completed will provide additional generating capacity of 30,000 kw., bringing the station rating to 65,000 kw., is well under way. The original capacity in 1924 when this plant was put in service was 15,000 kw. Work is expected to be completed about Sept. 1, 1928. There are now five 63,000-volt lines through which power is supplied from this station to Oklahoma Gas & Electric Company power users. Two of these lines extend to Oklahoma City, one to Drumright, one to Shawnee and one to the oil fields by way of Etowah.

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see ELECTRICAL WORLD for Jan. 7, page 80.]

American Welding Society—Engineering Societies Building, New York, April 25-27. M. M. Kelly, 29 West 39th St., New York.

American Electrochemical Society—Bridgeport, Conn., April 26-28. C. G. Fink, Columbia University, New York.

Missouri Association of Public Utilities—Jefferson City, April 26-28. F. D. Beardslee, 315 North Twelfth St., St. Louis.

Arizona Utilities Association—Prescott, Ariz., April 26-28. M. G. Sanders, Industrial Congress Bldg., Phoenix, Ariz.

Southwestern Public Service Association—Dallas, Tex., May 2-5. E. N. Willis, 403 Slaughter Bldg., Dallas, Tex.

American Institute of Electrical Engineers—New Haven regional meeting, May 9-11; national convention, Cosmopolitan Hotel, Denver, June 25-29. F. L. Hutchinson, 33 West 39th St., New York.

Middle West Division, N. E. L. A.—Hotel Statler, St. Louis, May 9-11. T. A. Browne, 1519 O St., Lincoln, Neb.

Arkansas Utilities Association—Arlington Hotel, Hot Springs National Park, May 14-16. R. I. Brown, Arkansas Power & Light Co., Little Rock.

American Society of Mechanical Engineers—Pittsburgh, May 14-17. Calvin W. Rice, 29 West 39th St., New York.

National Electric Light Association—Atlantic City, June 4-8. P. S. Clapp, 420 Lexington Ave., New York.

American Association of Engineers—Hotel Hussman, El Paso, Tex., June 4-6. M. E. McIver, 63 E. Adams St., Chicago.

Electrical Supply Jobbers' Association—The Homestead, Hot Springs, Va., June 5-8. E. Donald Tolles, 165 Broadway, New York.

National Electrical Manufacturers' Association—The Homestead, Hot Springs, Va., June 11-15. S. N. Clarkson, 420 Lexington Ave., New York.

Pacific Coast Division, N.E.L.A.—Hotel Huntington, Pasadena, Cal., June 12-15. S. H. Taylor, 447 Sutter St., San Francisco.

Georgia Electrical Association—Savannah, June 14 and 15. J. J. McDonough, Georgia Power Co., Dublin, Ga.

Northwest Division, N.E.L.A.—Portland, Ore., June 19-22. B. Snow, 1208 Spalding Bldg., Portland, Ore.

Canadian Electrical Association—SS. "Richelieu" from Montreal to Saguenay and return, June 20-23. H. M. Lyster, 712 Power Bldg., Montreal.

PROGRESS RAPID AT CHIPPEWA FALLS. —The power-house substructure for the Northern States Power Company's 27,000-hp. hydro-electric development at Chippewa Falls, Wis., is nearly 85 per cent complete, according to Vice-President H. W. Fuller of the Byllesby Engineering & Management Association. The development, of which previous accounts have been printed in these columns, calls for the construction of a dam about 1,030 ft. long and of a power house, approximately 280 ft. x 65 ft., on the north bank of the river. The plant is scheduled for completion Sept. 1 and will operate synchronously with the 42,000-hp. station at Wissota.

NEW PLANT PLANNED FOR TEXAS UTILITIES COMPANY. — Construction of a main power plant at some point in northwest Texas convenient to its present system of transmission lines and generating plants will be started soon by the Texas Utilities Company, according to J. B. Scott of Plainview, general manager of the company. A survey is now being made to determine the site for the proposed plant, he said. The power transmission system of the company extends to about 40 towns in the Panhandle, South Plains and eastern New Mexico. The company now owns power plants at Plainview, Lubbock and Canyon, all in Texas, and in Clovis, N. M.

LIVELY INTERCOMPANY WAR AT ALLIANCE, OHIO. — Commercial war between the Ohio Public Service Company, a subsidiary of the Cities Service Power & Light Company, and the Suburban Light & Power Company has been carried into two Ohio courts. The Suburban Light & Power was recently purchased by New York capitalists, and its headquarters were moved from Cleveland to Alliance. The Suburban constructed lines to territory where the Stark Electric Company had been distributing power under contract from the Ohio Public Service Company, planning to link its system with the Stark Electric lines. This was halted by a court injunction, and the Ohio Public Service Company is suing for breach of contract. The Ohio Public Service Company in its turn began to branch out in the Alliance territory, constructing a transmission line on a newly improved highway, and its workmen were arrested on trespassing charges. Then the Ohio Public Service Company secured an injunction which prevents the Suburban from removing poles erected by its competitor. The fight has spread to rural service. The Ohio Public Service has been charging rural customers more

than $200 each toward line construction. The Suburban has discontinued its connection cost where the property owner agrees to pay $5 a month, for which he can receive 100 kw.-hr., all over 100 kw.-hr. to be paid for at the rate of 5 cents a kilowatt-hour.

SUMMING UP NEBRASKA-IOWA STORM.—Final reports from the snowstorm that swept over a considerable portion of eastern Nebraska and western Iowa on April 6 show a total loss to public service companies of more than a million dollars. Of this total $850,000 was the share of communication companies and the remainder that of the power companies, especially the Nebraska Power and the Iowa-Nebraska Light & Power. Nearly twenty-five thousand poles went down. Temporary repairs by nearly two thousand linemen, drafted from unaffected territory, made restoration of service within a few days complete, but it will be several months before permanent work can be completed.

IOWA PUBLIC SERVICE COMPANY'S TROUBLES AT SAC CITY AND EMMETSBURG.—The Iowa Public Service Company and the Sac City (Iowa) authorities have reached an agreement in the litigation involving the location of poles and wires on the streets of the city, the utility company removing its distribution system pending an election at which it is seeking to obtain a franchise in Sac City. If it succeeds, a new system will be installed. At present Sac City, Odebolt and Schaller are supplied with power from the Sac County Electric Company. The Iowa Public Service Company has joined citizens of Emmetsburg, Iowa, in petitioning for an injunction to prevent the Municipal Utilities Company from erecting a municipal plant there. The last-named company agreed to operate the plant until its earnings had paid for the investment, at which time—estimated at eight years—the city was to take it over. The project was indorsed by a three-to-one vote at a special election on March 21.

SALT RIVER VALLEY WATER USERS PLAN NEW HYDRO-ELECTRIC PLANT.—The Salt River Valley Water Users' Association will construct an additional dam at Stewart Mountain below Mormon Flat to impound 70,000 acre-feet of water for the operation of a hydro-electric plant. Electric power from this source will go to supplement that which the association is already distributing in that part of Arizona. The Central Arizona Light & Power Company desires to enter into a 50-year contract for the purchase of power from the association at a cost of not less than $240,000 a year, and that company will distribute power to urban communities as well as farms. Owing to the income from power, now mainly from mining companies at Miami, Superior and Ray, the farmers' annual cost of water, on a seven-year average, has been, it is reported, only $3.18 an acre, compared with from $9 to $14 on other reclamation projects.

Recent Court Decisions

FUNCTION OF KANSAS COURTS IN RATE MAKING.—While the courts of Kansas have no rate-making powers, said the Supreme Court of that state in refusing an injunction asked for by the city of Hutchinson against the Hutchinson Gas Company to prevent it from putting a schedule of rates into effect pending the outcome of litigation, they may on proper occasion enjoin non-compensatory rates prescribed by the Public Service Commission and may also enjoin excessive rates promulgated by a utility company; but when a court declares the rates prescribed by the commission confiscatory, a company has the right to prescribe and collect rates of its own making until proper rates have been established by official authority, unless the company's interim rates are also declared unconstitutional. (264 Pac. 68.)*

MUNICIPALITIES SHOULD NOT OPERATE UTILITIES AT LOSS TO TAXPAYERS.—The Iowa Supreme Court, in Muscatine Lighting Company vs. City of Muscatine, has declared illegal an issue of bonds voted by the electors for the purpose of adding additional equipment to the city's electric plant. The company sued as a taxpayer to enjoin the disposal of the bond issue. The court said in part: "The establishment and construction of such a plant is not the exercise of those municipal functions which are in their very nature governmental but the exercise of those which are corporate and proprietary. The municipality in such undertaking incurs or may incur corporate liabilities which may greatly burden the taxpayer. It may therein bind itself by commercial contracts. It in practical operation furnishes heat, water, gas and electrical energy for commercial enterprises. If these are furnished at a loss or if the utility is not profitable, the loss falls on the taxpayer, who thereby is taxed not merely for his proportion of the cost of government, but for the city's loss and (perhaps) consumers' gain in commerce and industry. As a general proposition a municipality ought not to operate utilities at the expense of taxpayers any more than a private corporation ought to operate them at a loss to its stockholders. They should be made to pay their own way and the taxpayers ought not to be called upon to assume a burden that was never intended by the establishment." (217 N. W. 468.)

POLES, WIRES, CONDUITS AND LAMPS NOT ASSESSABLE AS REAL ESTATE.—The Commissioners of the District of Columbia have lost their appeal in the District Court of Appeals from a decision of the District Supreme Court that the poles, wires, conduits and lamps of the Potomac Electric Power Company are not assessable as real estate. Assessment was made and taxes were levied for the years 1917 to 1926, inclusive, and the power company sued for their cancellation and was sustained in the lower court. The company claimed that the act of 1902 requiring it to pay a tax of 4 per cent on its gross earnings was meant to include all the property of the company not otherwise taxable and covers the poles and conduits located on government property. The court admits that there is conflict of authority as to the exact status of such property of corporations in some states, but points out that the law of the District provides that all real estate shall be assessed in the name of the owner on a valuation to be determined as to each separate tract or lot of land, with the improvements thereon, and says it would require "a stretch of the imagination" to apply this statute to the poles, conduits, wires and lamps of the company erected upon the non-taxable property of the United States.

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

POOR AGRICULTURAL CONDITIONS BRING REDUCTION IN RATES.—The Oregon Public Service Commission has suspended for one year a tariff filed by the Idaho Power Company covering rates charged eastern Oregon consumers for power for limited irrigation pumping service. In lieu of these suspended rates a schedule of service and energy charges approximating a 10 per cent decrease in the original tariff is ordered. An emergency is declared by the commission to exist in this matter on the ground that the territory served by the Idaho Power Company with irrigation pumping service is dry and arid and that for several years the agricultural patrons of the company receiving this class of service have been earning only a meager livelihood.

HYDRO-ELECTRIC COMPANY'S DUTY IN THE MATTER OF FISHWAYS AND PORTAGE FOR BOATS.—Complaint was made to the Wisconsin Railroad Commission that the Neshonoc Light & Power Company had failed to provide adequate fishways around a dam across the La Crosse River, and complaint was also made that no provision had been made for the portaging of boats. The commission dismissed the complaint, saying with respect to the request for fishways that the testimony did not establish the need for any additional facilities of this character, the testimony showing that at periods of high water it was possible for fish to swim up over the apron of the dam in the flow without making a jump of any kind. The company offered to provide access for the purpose of portaging boats around the dam to any persons desiring access for this purpose.

RECEIPT OF POWER FROM ALLIED COMPANY DISAPPROVED.—Rates of the Amesbury Electric Company have been reduced by the Massachusetts Department of Public Utilities on petition by the selectmen of the town. The utility company was receiving part of its power from an affiliated company, which arrangement the department disapproved, stating: "The great majority of the customers of a public utility are willing to pay a fair and reasonable price for what a commodity or service honestly and rightfully costs, but they do not want the officers and directors of that utility entering into contracts or agreements whereby a private company may profit financially at the public's expense; nor do they want to be required to go to the trouble and expense of a rate case to ascertain whether such private company is so profiting. Such a situation only tends to keep alive that feeling of suspicion and distrust which is not for the best interests of the company or its consumers."

News About Men of the Industry

C. A. Ward Resigns as Head of Vehicle Company

Charles A. Ward, president of the Ward Motor Vehicle Company, Mount Vernon, N. Y., has resigned to become chairman of the board of the Ward Baking Corporation and also of the Ward Baking Company. Mr. Ward has been identified with the electric vehicle industry for approximately 25 years, organizing in Pittsburgh the business which formed the nucleus for the present Ward Motor Vehicle Company. He studied engineering at Cornell University and early in his career became interested in transportation. In addition to his activities in the electrical

C. A. Ward

field Mr. Ward devoted considerable time to the baking business, having been a member of the board of directors of the Ward Baking Company for a number of years. He has retained his position as a director of the Ward Motor Vehicle Company, but resigned as a director of the Society for Electrical Development after serving that organization for a number of years.

WILLARD F. PLACE has been elected a director of the Rochester Gas & Electric Corporation, Rochester, N. Y.

C. Y. FERRIS, of Stone, Webster & Blodget, Inc., has been elected a director of the Blackstone Valley Gas & Electric Company of Rhode Island. He becomes an additional director.

DR. JOHN B. WHITEHEAD, professor of electrical engineering and dean of the school of engineering of Johns Hopkins University, has been engaged as a consultant for the engineering and research staffs of the General Cable Corporation. He is to act in a close advisory capacity on wire and cable insulations and structures and will give particular attention to new developments of high-tension paper cables. Professor Whitehead has, over a period of years, devoted considerable time to cable research and has accomplished results of material benefit to the National Electric Light Association, the Engineering Foundation and the industry as a whole. He has likewise been active in the work of the American Institute of Electrical Engineers and the National Research Council. Professor Whitehead expects to continue his interests and co-operation with such agencies and his university work, but his association with General Cable will be his chief extra-curricular activity.

E. P. Peck Resigns

Emerson P. Peck has resigned as vice-president of the Utica Gas & Electric Company, Utica, N. Y., effective May 15. Mr. Peck will join the engineering and development division of the New York Power & Light Corporation in Albany, N. Y. Mr. Peck affiliated himself with the Utica company in 1919 and is responsible for almost the complete reconstruction of the electrical engineering department.

SAMUEL INSULL, JR., president of the Midland Utilities Company, Chicago, and an officer of other utility properties in the Middle West, sailed for Europe April 18 aboard the Cunard liner *Aquitania* for a short sojourn abroad.

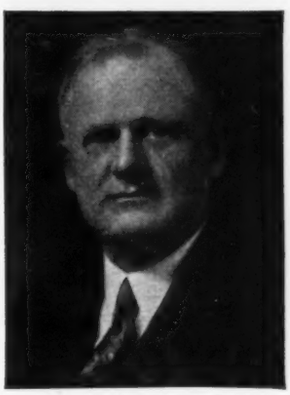
FRANCIS B. FLAHIVE, formerly assistant treasurer of the Columbia Gas & Electric Corporation, was elected treasurer of the Columbia system. For sixteen years he was associated with Stone & Webster in various financial and managerial capacities. Soon after his connection with the Columbia system in 1927 he was made assistant treasurer.

GEORGE T. LADD has been elected vice-chairman of the board of directors of the Combustion Engineering Corporation, New York. Mr. Ladd is an authority on the design and manufacture of steam boilers and has achieved marked success in this field. He is president of the Ladd Water Tube Boiler Company and president of the Heine Boiler Company.

EDWARD REYNOLDS, JR., was recently elected a vice-president of the Columbia Gas & Electric Corporation. He will continue to act as secretary of the corporation and have jurisdiction over its fiscal affairs. Mr. Reynolds was graduated from Harvard University in 1915 and received his early public utility experience with Stone & Webster in Boston, resigning from that position at the outbreak of the World War to enter the U. S. Navy. For 3½ years after the close of the war he was connected with the bond department of the Guaranty Trust Company and in the fall of 1922 joined the Columbia System as treasurer of the Columbia Gas & Electric Corporation.

J. C. Boyers New President of Ward Vehicle Company

J. C. Boyers, formerly vice-president in charge of sales of the Ward Motor Vehicle Company, Mount Vernon, N. Y., has been elected president of that organization to succeed Charles A. Ward, resigned. Mr. Boyers becomes active managing head of the company after an association with the electric vehicle industry which covers a period of fifteen years. Some years ago Mr. Ward chanced upon Mr. Boyers in the vicinity of New Rochelle and induced him to join the Ward Motor Vehicle Company. Mr. Boyers threw in his lot with Mr. Ward and it was not long



J. C. Boyers

before he was named vice-president. His activities have not been confined to the transportation field, for he is a director of the American National Bank of Mount Vernon, the Jefferson Title & Mortgage Company and a vice-president of the Community Trust Company.

HUGH L. FORMAN has been named vice-president in charge of sales of the Ward Motor Vehicle Company, to succeed J. C. Boyers, now president. Mr. Forman was identified with the Ward Motor Vehicle Company for five years prior to the war, but he severed this connection to enter military service. Subsequently he affiliated himself with the Franklin Automobile Company of Syracuse, N. Y.

WILLIAM C. BELL, vice-president of the Rhode Island Public Service Company and general manager of the Narragansett Electric Lighting Company, Providence, has been appointed vice-president of the New England Power Association, with headquarters at Boston, Mass. Mr. Bell was educated at the University of California, and after service with the Pacific Gas & Electric Company and San Francisco Power Company he went to Richmond, Va., in 1911, later becoming general manager of the Virginia Electric & Power Com-

pany. About a year ago he was made general manager of the Narragansett company, and has already acquired a high reputation among the younger central station executives of New England.

C. A. Collier Heads Southeastern Division

Charles A. Collier, vice-president of the Georgia Power Company, Atlanta, was elected president of the Southeastern Division of the National Electric

C. A. Collier

Light Association at the convention held during the past week in Miami, Fla. Mr. Collier has been identified with the public utility industry in the Southeast since 1909, the year in which he was graduated from the Georgia School of Technology. Starting as inspector of wiring and motors with the Georgia Railway & Electric Company, he soon was promoted to the position of industrial power sales engineer, and one year later became power sales engineer for large industries. Subsequently, he was appointed assistant to the contract agent of the parent company, the Georgia Railway & Power Company, his special duties being investigation work on customers' power installations, especially on industrial plants.

After advancing from assistant to the sales manager, assistant to the operating and sales manager and assistant to the general sales manager to the position of general sales manager, he was elected last summer a vice-president of the Georgia Power Company, successor to the Georgia Railway & Power Company, in charge of commercial activities. For many years Mr. Collier has been prominently identified with the Southeastern Division and with local association work in Atlanta.

F. Harper Craddock and C. Maynard Turner, Olympia, have been appointed respectively to the positions of chief engineer and assistant chief engineer of the Department of Public Works of Washington. Mr. Craddock has been with the department for five years. He is a graduate civil engineer from Rensselaer Polytechnic Institute and has had fifteen years' experience on railroad, municipal works and building construction and appraisal work in various sections of the United States. Mr. Turner has had several years' experience in the distribution and operating departments of the largest private and municipal electric utilities in the Northwest and was, for two years, employed as sales engineer for the Westinghouse Electric & Manufacturing Company.

Victor H. Tousley of Chicago has been appointed to the position of electrical field secretary of the National Fire Protection Association, succeeding in this capacity W. J. Canada, who is now identified with the National Electrical Manufacturers' Association. Mr. Tousley will assume his new duties on May 1, 1928, and will temporarily have an office at the Underwriters' Laboratories, Chicago. He is widely known throughout the country in electrical circles. Mr. Tousley has been associated with the department of gas and electricity of the city of Chicago for the past 25 years and for the past fifteen years has been chief electrical inspector of that department. He was graduated from the American Institute of Technology, Chicago, as electrical engineer, is the author of a series of books on electrical construction and has been a frequent contributor to technical magazines. He has for many years been an active member of the Western Association of Electrical Inspectors, of which organization he was president from 1910 to 1912. He has been a member of the electrical committee (National Electrical Code) of the National Fire Protection Association for the past fifteen years. Mr. Tousley is past-president of the Electric Club of Chicago.

S. B. Swan General Manager in Providence

Samuel B. Swan, formerly electrical engineer and more recently superintendent of distribution of the Narragansett Electric Company, Providence, R. I., has been appointed general manager of the company, succeeding W. C. Bell. Mr. Swan has been in the service of the company for eighteen years and is one of the best-known electrical engineers in the New England utility field.

S. B. Swan

He has played an important part in the development of the Narragansett system from an urban property to an extended organization serving a large portion of the state and today forming a vital part of the New England Power Association system. Mr. Bell has assumed new duties in Boston.

Obituary

William Robert Quinn, well-known designer of fuel-oil-burning equipment, died suddenly in his room at the Hotel Manger, New York, April 12. Mr. Quinn had been a resident of San Francisco for several years past, having gone there as the Pacific Coast representative of the Combustion Engineering Corporation. He was in New York on a business trip at the time of his death. Mr. Quinn was president of the Quinn Oil Burner & Torch Company until this company was purchased by the Combustion Engineering Corporation in 1922.

A. L. Broomall, manager of the renewal parts engineering department of the Westinghouse Electric & Manufacturing Company, died April 10 at his home in Wilkinsburg, Pa., from pneumonia. Mr. Broomall's first important work was on the installation of the first electric locomotives on the New York, New Haven & Hartford Railroad. From 1911 to 1915 he had charge of the design of electric vehicle motors and then he was appointed section head of the direct-current motor section. In 1922 he was transferred to the renewal parts engineering department as engineer in charge, later becoming manager of the department, which position he held when he died. He was a member of the A.I.E.E.

Charles E. Corrigan, for many years a prominent figure in the manufacturing branch of the electrical industry, died suddenly in Jacksonville, Fla., March 24 following an operation. Mr. Corrigan was formerly vice-president of the National Metal Molding Company, Pittsburgh, but he retired in 1926 from active work, removing to Sarasota, Fla., where he became interested in poultry culture. During his career Mr. Corrigan devoted considerable time to association work, being especially interested in the affairs of the Associated Manufacturers of Electrical Supplies. He was considered an authority on concentric wiring and for many years held the chairmanship of the conduit section of the Associated Manufacturers of Electrical Supplies as well as membership on many other committees of that organization and on the board of governors. Mr. Corrigan relinquished his association activities when he retired and established a residence in Florida.

Financial and Statistical News

Decline in General Market Utility Stocks Strong

WITH transactions on the Stock Exchange still running in the neighborhood of 4,000,000 shares daily, selling pressure made itself felt during the past week and the market moved downward. In spite of the trend of the general market the light and power stocks held firm and substantial gains were recorded by many. The index of common stocks of fifteen representative light and power companies advanced five points over the preceding week. Brooklyn Edison advanced eight points, Columbia Gas & Electric ten, Detroit Edison ten, Public Service Corporation of New Jersey ten and Pacific Gas & Electric six. The Electric Bond & Share group was conspicuously strong. Electric Bond & Share securities advanced 36 points during the week under review, from 90 to 126, and Electric Investors advanced eleven points, from 49 to 60. General Electric showed marked progress and A. T. & T. rose to the highest level in the history of the company on the New York Stock Exchange, reaching 190¼.

Utility Stocks Popular with Investment Trusts

Pointing out that the effect of investment trust buying is very important in the present securities market, the Babson Statistical Organization, Babson Park, Mass., bulletin of April 10 tabulated the popularity of public utility common stocks and various industrial, railroad and oil stocks held by five or more in a group of 31 investment trusts which make public their holdings. The number of trusts holding utility stocks and the companies represented follow:

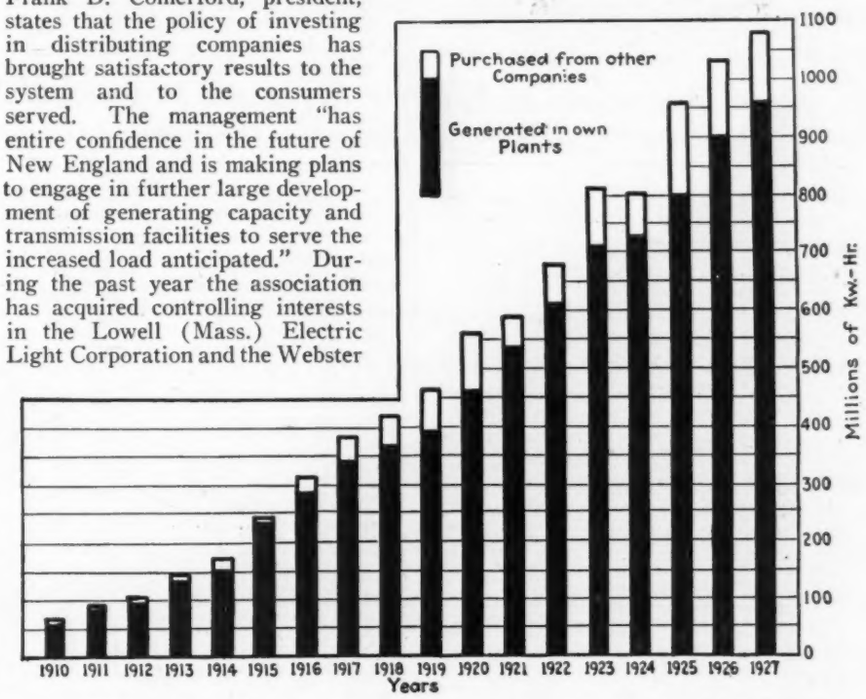
American Telephone & Telegraph, 15; Consolidated Gas of New York, 13; North American, 12; American Gas & Electric, 10; American Power & Light, 9; Brooklyn Edison, 9; Columbia Gas & Electric, 9; International Telephone & Telegraph, 9; Southern California Edison, 9; Western Union Telegraph, 9; Detroit Edison, 8; Public Service of New Jersey, 8; Standard Gas & Electric, 7; Commonwealth Power, 6; National Power & Light, 6, and United Gas Improvement, 6.

Six trusts hold 180,000 shares of American Gas & Electric, four trusts hold 450,000 shares of American Power & Light and three hold 539,000 shares of National Power & Light. Among industrials, seventeen investment trusts hold General Electric and ten Westinghouse stock. Commenting on the quality of the holdings, the report says:

These trusts hold (in all classes) several billion dollars worth of stocks. . . . In a way the compilation represents the consensus of opinion as to the best stocks for permanent holding. While all of the investment trusts represented in this compilation are not necessarily the largest or the most conservative, nevertheless the combined results of this study should be fairly representative of all investment trust holdings. . . . The class of securities most held is very good indeed and the large volume of trust buying has undoubtedly been a big factor in pushing up the prices of these stocks to present high levels. On the other hand, when the next period of liquidation comes, these holdings by investment trusts will not prevent drastic declines in stock prices.

New England Power Association Expands

MATERIAL progress in development of additional generating capacity, in improvement of transmission facilities and in enlargement of outlets for power featured the activities of the New England Power Association in 1927. In his annual report to stockholders Frank D. Comerford, president, states that the policy of investing in distributing companies has brought satisfactory results to the system and to the consumers served. The management "has entire confidence in the future of New England and is making plans to engage in further large development of generating capacity and transmission facilities to serve the increased load anticipated." During the past year the association has acquired controlling interests in the Lowell (Mass.) Electric Light Corporation and the Webster & Southbridge Gas & Electric Company. The most important construction work undertaken was the 60,000-hp. hydroelectric plant on the Connecticut River at Bellows Falls, Vt. Thanks to the thorough development and regulation of the Deerfield River by the New England Power Company the November flood did little damage in the immediate section of New England, and flood conditions did not materially affect other plants of the system. A large amount of line and substation construction was completed during the year and an important tie-in was made between the system and the United Electric Railways plant at Providence, R. I. Sales of power show a gain in output for the year, despite somewhat uneven industrial conditions.



Kilowatt-hour production of the New England Power Association

The gross operating revenue, eliminating intercompany sales, was $27,378,

Growth of Companies Comprising New England Power Association

Year Ended Dec. 31	Earnings		Customers		Kilowatt-Hours Generated (000 Omitted)	Kilowatt-Hours Purchased (000 Omitted)	Kilowatt-Hours Total (000 Omitted)	Total Gas Production M C F
	Gross	Net*	Electric	Gas				
1923	26,027,969	8,630,547	115,413	43,369	777,644	98,866	876,510	1,123,730
1924	26,079,499	9,000,990	134,603	44,729	779,784	86,668	866,452	1,089,169
1925	28,535,723	10,913,024	150,565	44,848	867,438	140,360	1,007,798	1,098,839
1926	29,076,789	11,949,741	167,805	45,367	941,675	129,747	1,071,422	1,120,644
1927	29,828,095	13,801,027	190,830	43,962	982,269	122,249	1,104,518	1,142,611

*Net before depreciation and federal income taxes.

251; other income, $1,400,409, and total income, $28,778,661. Expenses other than maintenance, depreciation and taxes were $10,827,403; maintenance, $2,782,-269; depreciation, $2,687,083, and taxes, $2,523,271, leaving net earnings before interest and dividends, $9,958,633. Net consolidated earnings after interest and preferred and class A dividends of subsidiaries were $4,477,934. Preferred dividends of the association totaled $1,-910,421, leaving $2,567,512 net earnings applicable to common shares, or $3.37 per share. Gross assets were $210,237,106, of which capital assets accounted for $181,310,871. The stabilizing effect of the diversification of the system's electrical load is indicated in the following percentage analysis of its revenue from sales of electricity for the year 1927: Public utilities, 17.1; industrials, 47.2; railways, 3; miscellaneous, 4.97 and residential and commercial lighting, etc., 27.8. The number of electric customers increased during the year from 167,805 to 190,830, and the total energy generated and purchased from 1,071,422,000 kw.-hr. to 1,104,518,000 kw.-hr. Over 250 communities having a population in excess of 2,500,000 are served by the system, either directly or through contracts with local distributing companies. The major portion of the energy sold by the system is in large blocks under long-term contracts to many prominent industrial concerns and local distributing companies. The table which appears on page 835 shows the growth of the properties now comprising the system.

NEW NO-PAR PREFERRED ISSUE APPROVED FOR BUFFALO, NIAGARA & EASTERN.—The Buffalo, Niagara & Eastern Power Corporation has filed a certificate at Dover, Del., increasing the authorized capitalization by 500,000 shares of $5 cumulative dividend first preferred stock of no par value. According to present plans not more than 350,-000 shares of this new stock will be issued to acquire by exchange or to provide funds for the redemption of preferred stock of the Niagara Falls Power Company, the Niagara, Lockport & Ontario Power Company and the Tonowanda Power Company.

Macomber Heads N.E. Power Minority Interest

Arrangements have been consummated under which a group of Boston business interests, headed by John R. Macomber of Harris, Forbes & Company, will take over the minority holdings in the New England Power Association hitherto in the hands of F. L. Carlisle & Company, the Northeastern Power Corporation and Stone & Webster, Inc. These holdings compose about 40 per cent of the common stock of the association. The holdings of the International Paper Company in the association remain undisturbed. These represent about 45 per cent of the common stock. The new group is friendly to the present management of the association, as is the International Paper Company.

PUBLIC SERVICE PRODUCTION ELECTS DIRECTORS.—At a meeting held April 17 the Public Service Production Company, Newark, N. J., elected the following directors: Dwight P. Robinson,

Stock Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday April 17	Low 1928	High 1928
ABITIBI PWR. & PAPER, com., new — no par	78	72	81
Ala. Pwr., $7 cum. pf.—no par	k114¼	114¼	115¼
Allis Chalmers Mfg.,6% com.	124¾	115¼	127¼
Aluminum Co. of Amer., com.	143¾	120	150
Aluminum Co. of Amer., 6% pf.	109½	105¼	109¾
Amer & Foreign Pwr., 7% pf.— no par	108	105¼	109
Amer. & Foreign Pwr., com.—no par	31¼	22¾	27¾
Amer. Bosch Magneto, com.—no par	25¼	15¼	28¼
Amer. Brown Boveri Elec.†	14¾	10¼	18
Amer. Brown Boveri Elec., pf. $7	52	46½	63
Amer. Gas & Elec., 6% pf.—no par.	k108	105	108¼
Amer. Gas & Elec., com. †—no par.	139½	117¼	145
Amer. Lt. & Trac., 6% pf.	116	116	120
Amer. Lt. & Trac., new com.	220	170	220
Amer. Pwr. & Lt., 6% pf.	107½	104	109¾
Amer. Pwr. & Lt., com. †—no par	80¼	62¼	83
Amer. Pub. Serv., 7% pf.	98¾	97¼	101
Amer. Pub. Serv., com. †	k 70	70	75
Amer. Pub. Utilities, 7% pfc. pf.	a 96½	87½	96¾
Amer. Pub. Utilities, 7% pr. pf.	a100½	95¾	101
Amer. Pub. Utilities, com.	k 60	60	65
Amer. States Sec., A	a 10¾	4	9
Amer. States Sec., B	a 12	4¼	9¼
Amer. Superpwr., 6% 1st pf.	l103	....	....
Amer.Super pwr., Class A†—no par	51¾	37	46¼
Amer.Super pwr., Class B†—no par	53¼	37¼	48
Amer. Wtr. Wks. & Elec., 6% pf.	105½	101¼	105
Amer. W.W. & E., com. new—no par	61	52¼	61
Anaconda Copper cap. $3	68¼	54¼	72¾
Appalachian Electric Pwr., 7% pf.	109	108¼	110
Arkansas Pwr., & Lt. 7% pf	107¼	108	109¼
Assoc. Gas & Elec., $3.50—50	54¾	....	....
Assoc. Gas & Elec., pf.—$6—no par.	96	96	98¼
Assoc. G. & E., Class A, 10—no par.	48¾	47	51¼
BABCOCK & WILCOX, 7% com.	119	117¼	124¾
Binghamton L., H. & P., $6 pf.	108¾	102	108¼
Birmingham Elec., pf.—$7—no par.	k109½	109¼	111
Blackstone Valley G. & E., 6% pf.	m106	106	112
Blackstone Valley Gas & Elec., 10% com.—50	k158	135	165
Blaw-Knox, com.†	d102	91	105
Brazilian Trac., Lt. & Pwr., $7 com.	f240	....	....
Brazilian Trac., Lt. & Pwr.,com.,new	f 60	....	....
Broad River Pwr., 7% pf.	105	105	108
Brooklyn Edison, 8% com.	258	206¼	253
Buffalo, Niagara & East. Pwr., $1.60 pf.—25	l 26¼	....	....
Buffalo, Niagara & East. Pwr. com. $1.20—no par	l 42	....	....
CALIFORNIA ELEC. GENERATING, 6% pf.	99	98	101
California Ry. & Pwr., 7% pf.	135	....	....
Carolina Pwr. & Lt., pf.—$7—no par	l111	109	110½
Central & S. W. Util., $7 pf.—no par	a104	99¼	105¼
Central & S. W. Util., pr. in. $7 pf.—no par	a109	103¼	108
Central Ark. Ry. & Lt., 7% pf.	104	105	107
Central Ill. Pub. Serv., $6 pf.	a 98½	97¾	100½
Central Ind. Pwr., 7% pf.	a 99½	95	99¾
Central Maine Power, 6% pf.	96	96	98
Central Maine Power, 7%	109	109	112
Central Pwr. & Lt., 7% pf.	109	104½	105¼
Central States Elec., 7% pf.	117¾	104¼	114
Century Elec., 6% com.	m135	135	145
Cincinnati Gas & Elec., 5% com.	c100	97¼	100
Cities Service, $6 pf.—no par	l 99¾	94¼	100
Cities Service, pf. B—no par	l 9	8	9¼
Cities Service, pf. BB—no par	k 93¾	88¼	95
Cities Service, com.—20	l 58	54	59¾
Cities Service, Bks. Shrs.—10	m28¾	28¾	28¾
Cities Service Pwr. & Lt., 7% pf.	k107¾	106	109½
Cities Service Pwr. & Lt., 6% pf.	k 99	95	100
Cleveland Elec. Illg., 6% pf.	112¾	113	115¼
Cleveland Elec. Illg., 10% com.	400	350	410
Columbia Gas & Elec., 6% pf.	109¾	107¼	110¾
Columbia G. & E. com. $5—no par.	106¾	89¼	97¾
Columbus Elec. & Pwr., $2 com.—no par	k 77¼	66	79
Columbus Elec. & Pwr., 7%	112	....	....
Columbus Ry., Pwr. & Lt., 7%	108¾	....	....
Columbus Ry., Pwr. & Lt., 7 %pf. B	108	....	....
Columbus Ry., P.& I t. com.—no par	k115	....	....
Commonwealth Edison, 8% com.	a181½	165	189
Commonwealth Pwr., 6% pf.	103¾	102¼	104¼
Commonw'th Pwr., $2, com.—no par	84¼	62¼	84¼
Conn. Lt. & Pwr., 8% pf.	122	120	125
Conn. Lt. & Pwr., 7% pf.	117	118	121
Cons. Gas of N. Y., pf.	104	101¾	105
Cons. Gas of N. Y., com. $5—no par.	155½	119¾	149¾
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf.	e111¼	110	113
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf.	m111¼	110¼	114¼
Cons. Gas, Elec. Lt. & Pwr. of Balti., 5% pf.	e104¼	100¼	105¼
Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $3.00—no par	e 79¼	67¼	80
Consolidated Pwr. & Lt., 7% pf.	105	....	....
Consumers Pwr., 6% pf.	104¾	105¼	106¼
Consumers Pwr., 6.6% pf.	105	106	107
Continental Gas & Elec., 7% pr. pf.	108	106¼	108¼
Contl. G. & E. com. $4.40—no par.	k230	240	265
Crocker Wheeler, com.†	k 38	24	38
Crocker Wheeler, 7% pf.	k 90	77	95
DALLAS PWR. & LT., 7% pf.	110	110	111¼
Dayton Pwr. & Lt., 6% pf.	108¼	108¼	109¼
Derby Gas & Elec., 7% pf.	102	96	100¾
Detroit Edison, 8% com.	190½	166¾	194¼
Dubilier Condenser, com.—no par.	5¼	2¾	5¼
Duke Pwr., cap.	k143	130	145
EASTERN NEW YORK UTIL., $7 pf.	k110½	111	112¾
Eastern States Pwr. B	22	11¼	22
Eastern States Pwr., pf.	k 98	98	99
East. Tex. Elec., 7% pf.	107½	106	109
Edison Elec. of Boston, $12 com.	d280	252	280
El Paso Elec. 7% pf.	113	110	112¼
Elec. Bond & Share, 6% pf.	l109½	108¼	111¼
Elec. Bd. & Sh. Sec., com. $1—no par	l119¼	76	126
Electric Household Util.†	a 23	13¼	24
Elec. Investors, 6% pf.—no par.	103	101	103½
Elec. Investors, com.†—no par.	60¼	40¼	60¼
Elec. Pwr. & Lt., ctfs. pf., ex.div.	k109½	106¼	110¼
Elec. Pwr. & Lt., ctfs., com.—no par ex.div.	k 33¼	28¼	40¼
Elec. Ry. Securities, com.—no par.	7	....	....
Elec. St. Battery com. $5.25—no par	81¼	69	83¼
Elmira Wtr., Lt. & R.R., 7% pf.	106¼	104	107
Empire Pwr., pfc.†	32¼	27¼	35¼
Engr. Pub. Serv. $7, pf.—no par.	110¼	107	110¼
Engr. Pub. Serv., com.—no par.	41¼	33	42¼
Eureka Vacuum Cleaner, com. $4—no par.	76¼	69	79
FAIRBANKS MORSE, 7% pf.	109¼	104	110
F.-M., com.—$3—no par.	47¼	32¼	48¼
Federal Lt. & Trac.,com $1.40	54	42	56¼
Federal Lt. & Trac., $6 pf.—no par.	107¾	98	107¼
Florida Pwr. & Lt., 7% pf.	k108	105	108¼
Ft. Worth Pwr. & Lt., 7% pf.	k114	113	114¼
GALVESTON-HOUSTON ELEC. 6% pf.	82	75	85
Galveston-Houston Elec., com.	36	31	38
General Cable, Cl. A	75¼	56	84¼
Gen. Elec. $3 com.—no par.	173	124	174¼
Gen. Elec., special—6%	11¾	11¼	11¾
Gen. Gas & Elec. (Del.) com A $1.50—no par.	44¼	35¼	44¼
Gen. G. & E. (Del.) pf. A $8—no par	141	122¼	141
Gen. G. & E. (Del.) pf. A $7—no par.	k120	108¼	113¾
Gen. G. & E. (Del.) pf. B $7	k111	105¼	111
Gen. Pub. Serv., $7 cum. pf., no par.	k117	110	120
Gen. Pub. Serv., com., no par	21¼	16¾	21¾
General Public Utilities, $7 pf.	k 58	55	65
Ga. Lt., Pwr. & Rys., com.	k 58	55	65
Gt. Western Pwr., 7% pf.	h105	....	....
IDAHO PWR., 7% pf.	110¼	109	110¾
Ill. No. Utilities, 6% pf.	a100¾	98¼	100¾
Ill. Pwr. & Lt., 7% pf.	105	103	107
Indianapolis Pwr. & Lt., 6% pf.	105½	102	107¼
Indianapolis Pwr. & Lt., $7 pf.	103	100	105
Ingersoll Rand com.	96¼	90	94
Int. Combus. Engr., com. $2—no par	50¼	45¼	55¼
Int. Combustion Engr., 7% pf.	103¾	103	105¼
Int. Util., Class A—$3.50—no par	46¼	44¼	51¼
Int. Utilities, Class B—no par.	9	6¾	10¼
Interstate Pwr., pf.—$7—no par.	103	99	103¾
Interstate Pub. Serv., 7% pf.	104¾	103	106
Iowa Ry. & Lt., 7% pf.	101	102	103
JERSEY CENTRAL PWR. & LT. CO., 7% pf.	108	105	107
Johns-Manville, com.†—no par.	124¼	111¼	133¾
Johns-Manville, 7% pf.	122¾	119¼	121¾

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid price Saturday, April 14. lBid price Wednesday, April 18. mLatest quotations available. †Dividend rate variable.

Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday April 17	Low 1928	High 1928
KANSAS GAS & ELEC. 7% pf.	*l*110¾	107	1i0
Kelvinator Corp.	21¼	11¼	21¾
Kentucky Hydro-Elec., 7% pf.	*m*104¼	102	104¼
Kentucky Sec., 6% pf.	92	94	98
Kentucky Sec., 5% com.	150	140	150
Kentucky Utilities, 6% pf.	103	100	103
LACLEDE GAS LT., 10% com.	*k*200	200	260
Lehigh Pwr. Sec., com.—no par	32½	19¼	27¾
Long Island Ltg., 7% pf.	*k*110¼	110¼	110¼
Long Island Ltg., 6% pf.	*k*108	107	108½
Long Island Ltg., com.†—no par	*k*178	170	185
Los Angeles Gas & Elec., 6% pf.	111	105½	111¼
Louisville Gas & Elec., cl. A. $1.75	34	28	35
MAN. ELEC. SUPPLY, cap. $5—no par	55½	50	61
Maytag Mfg., com.50—no par	37	30	38¼
Memphis P. & L., pf.—$7—no par	111	109	111
Metropolitan Ed., pf.—$6—no par	108½	103	108½
Metropolitan Ed., pf.—$7—no par	109	109	111
Metropolitan Ed., com. $5—no par	*k*160	125	155
Middle West Utilities, 7% pf.	*a*121½	116¼	124¼
Middle West Util., 7% pr. lien	*a*126	125	129½
Middle West Util., com. $6—no par	*a*142½	123½	142¾
Midland Utilities, pr. ln. 6% pf.	*a* 95¼	94½	97
Midland Utilities, 6% pf. A	*a* 91	89½	92¼
Milwaukee Elec. Ry. & Lt., 7% pf.	*k*104	100	103
Milwaukee Elec. Ry. & Lt., 6% pf.	102	98	101½
Minn. Pwr. & Lt., 7% pf.	*l*108¾	107	109
Miss. River Pwr., 6% pf.	108	94	109¼
Miss. River Pwr., 3% com.	110	....	....
Mohawk Hudson Pwr., 1st pf.—$7—no par	*k*107½	100	110
Mohawk Hudson Pwr., 2d pf.—$7—no par	*k*104	100	109
Mohawk Hudson Pwr., com.—no par	35½	29½	36¼
Montana Pwr., 5% com.	165	102½	169¾
Montreal Pwr., 7% com.	*f* 97½	....	....
Mountain States Pwr., 7% pf.	106½	97	105
Mountain States Pwr., com.†	17½	....	....
NASSAU & SUFFOLK LTG., 7% pf.	109	98	110½
National Carbon, 8% pf.	*a*138½	138	139½
National Elec. Pwr., A†	*a* 31½	27½	32¼
National Lt., Ht. & Pwr., com.	*k* 24	20	30
National, Light, Ht. & Pwr., 5% pf.	72	70	80
National Pwr. & Lt., pf.—$7—no par	109½	*m*108½	111
National Pwr. & Lt., com.†—no par.	32½	21¾	27¾
National Pub. Serv., 7% pf.	101	99	103
National Pub. Serv., 7% ptc., pf.	114	....	....
National Pub. Serv., A com. $1.60—no par	25½	22	27½
National Pub. Serv., B com.—no par	*m* 28¾	24½	30
Nebraska Pwr., 7% pf.	*l*111	110	111½
Nevada-Calif. Elec., com.	35½	22	37
New Brunswick Pwr., 4% pf.	62	60	70
New Eng. Pub. Serv., pr. ln. pf. $7	108	98½	109½
New Eng. Pub. Serv., pf. $7	106	95	108
New Orleans Pub. Serv.—7% pf.	108	106	110
N. Y. & Queens Elec. Lt. & Pwr., 5% pf.	100	91	100
N. Y. Central Elec., 7% pf.	105	101	105½
New York Power & Light 7% pf.	115½	....	....
Niagara Falls Pwr., 7% pf.—25	27	27	28¼
No. Amer., 6% pf.—50	54	53½	55
No. Amer., com.—10	67½	58½	67
No. Amer. Edison, $6 pf.—no par	104	102½	105½
Northeastern Pwr., com.	26½	19½	26½
No. N. Y. Utilities, 7% pf.	107	103	109
No. Ohio Pwr., com.—no par	26½	18	27½
Northern Ohio Pwr. & Lt., 6% pf.	99	90	99
No. Ont. St. & Pr. 6% pf.	*k*100	94	100
No. Ont. Lt. & Pwr., 4% com.	*k* 72	73	78
No. States Pwr. (Del.), 7% pf.	109¾	101	110
No. States Pwr. (Del.), 8% com.	147½	123	136¾
No. Texas Elec., 6% pf.	54½	45	70
No. Texas Elec., com.	17	....	....
OHIO BRASS, com. B $4—no par.	*k*106	90	107
Ohio Brass, 6% pf.	*k*107	106	111
Ohio Pwr., 6% pf.	108½	104	107½
Ohio Pub. Serv., $6 pf.	105	95	105
Ohio Pub. Serv., 7% pf.	113	107	112
Ohio River Edison, 7% pf.	108½	106	109¾
Oklahoma Gas & Elec., 7% pf.	115¾	106	115½
PACIFIC Gas & ELEC., 6% pf.	*k* 29½	26¾	29½
Pacific Gas & Elec., 8% new com.	48	43½	49¼
Pacific Pwr. & Lt., 7% pf.	*l*110½	106	110
Penn Cent. Lt. & Pwr., $5 pf.—no par	*c* 80½	79¼	82
Penn-Ohio Edison, 6% pf. no par	97	93	99
Penn-Ohio Edison, 7% pf.	*k*106½	97½	104
Penn-Ohio Pwr. & Lt., 7% pf.	110	99	110
Penn Pwr. & Lt.—$7—no par	*l*110	109½	110½
Penn Wtr. & Pwr., $2.50 com., new	*e* 76	68	76
Phila. Co., 5% pf.—50	*k* 45½	45½	48½
Phila. Co., 6% pf.—50	56½	52	57
Phila. Co., com.—50	*k*165½	145	165½
Phila. Elec., 8% com.—25	*c* 66½	55½	66¾
Portland Elec. Pwr., 7% pf.	102½	100	104½
Portland Elec. Pwr., 6% pf.	94	78	96
Portland Elec. Pwr., 6% 2d pf.	85	55	88
Portland Elec. Pwr., com.	51	42½	52
Potomac Elec. Power, 6% pf.	*l*113	....	....
Pwr. Sec., pf.—no par	*k* 65	50	68
Pwr. Sec., com.—no par	12	5	15
Public Serv. of Colorado, 7% pf.	105	....	....
Pub. Serv. of N. J., 6% pf.	109	103½	109½
Pub. Serv. of N. J., 7% pf.	125½	118	121½
Pub. Serv. of N. J., $2 com.—no par	52½	41½	49¾
Pub. Serv. of No. Ill., 6% pf.	*a*113	110	115
P. S. of No. Ill., com. $8—no par	*a*173	159½	180
Pub. Serv. of No. Ill., $8 com.	*a*174½	159½	180
Pub. Serv. of Okla., 7% pr. ln.	106½	100	107
Pub. Serv. Elec. & Gas, 6% pf.	109½	108	110¼
Puget Sound Pwr. & Lt., 7% pf.	110½	109	113
Puget Sound Pwr. & Lt., $6 pf.—no par	*k*100	96½	99
Puget Sound Pwr. & Lt., com.	74½	34½	63½
RADIO CORP. OF AMER., $3.50 pf.—50	*k* 56	54½	57½
Radio Corp. of Amer., com.—no par.	165½	85½	196½
Rochester Gas & Elec. 6% pf. D.	105½	105½	106½
Rochester Gas & Elec., 7% pf. B.	107	105	107
Rochester Gas & Elec., 6% pf. C.	105½	105½	106½
SAN JOAQUIN Lt. & Pwr., 7% pr. pf.	110	110	117½
St. Joseph Ry., L., H. & P., 5% pf.	*k* 75	70	75
Servel, Inc.	9¼	4½	10¼
Sierra Pacific Elec., 2% com.	35½	29	38½
Sioux City Gas & Elec., 7% pf.	107½	100	108½
Southeastern Pwr. & Lt., pf.—$7 no par	*l* 109	....	....
Southeastern Pwr. & Lt., ptc. pf.	*l* 89	....	....
Southeastern Pwr. & Lt., com.—no par	53½	41¾	48¾
So. Calif. Edison, 8% pf.	28	38½	41
So. Calif. Edison, 7% pf.	29	27	29½
So. Calif. Edison, 6% pf.	27	25½	28
So. Calif. Edison, 8% com.	46½	43½	48¾
Southern Cities Utilities, 7% pf.	80½	75	87
Southwestern Lt. & Pwr., A $3.	80	60	80
Southwestern Lt. & Pwr., B	65	60	65
Southwestern Lt. & Pwr., $6 pf.	93	88	92½
Southwestern Pwr. & Lt., 7% pf.	114½	103	113
Standard Gas & Elec., 8% pf.	70½	65	70½
Standard Gas & Elec., 7% pr. pf.	114	110½	115
Standard G. & E., com. $3.50	67½	57½	66¾
Standard Power & Light, com.	44½	29½	45
Standard Pwr. & Lt., 7% pf.	*k*105	98	105
Staten Island Edison, pf.—$6—no par	102½	99	103¾
Superheater, $6 com.—no par	*m*162	162	175
Syracuse Lighting, 7% pf.	110	103	111
Syracuse Lighting, 8% pf.	*k*117½	114	119
TAMPA ELEC., com. $2	*k* 68½	62	69½
Tenn. Elec. Pwr., 6% pf.	103½	92	103
Tenn. Elec. Pwr., 7% pf.	109	107	110
Terre Haute, Ind. & East. Trac., 5% pf.	*k* 10	....	....
Terre Haute, Ind. & East. Trac., com.	*k* 1	1	3
Tex. Pwr. & Lt., 7% pf.	*l*113½	113½	113½
Tide Water Pwr., 8% pf.	112	108	112
Timken Roller Bear., com.—$4 no par	131	112½	134
Toledo Edison, 7% pf.	109½	108	111
Toledo Edison, 6% pf.	105	95	105
Toledo Edison, 6% com.	*k*145	120	150
Tri-City Ry. & Lt., 6% pf.	90	93	102
UNITED GAS & ELEC., 7% pf.	95	98	103
United Gas & Elec. (N. J.), 5% pf.	75	70	77
United Gas Impr., 8% com.—50	*c*134½	111½	134½
United Lt. & Pwr., pf.—$4—no par.	*a* 57	53	57
United Lt. & Pwr., pf.—$6.50—no par	*a*102	95	102
United L. & P., com. A .48—no par	*a* 25½	14	25½
United L. & P., com. B .48—no par.	*a* 29½	19	30
Utah Pwr. & Lt., 7% pf.	*l*112½	109½	112
Utica Gas & Elec., 7% pf.	105½	105	106½
Utica Gas & Elec., 8% com.	*k*200	215	225
Utilities Pwr. & Lt., 7% pf.	101	98	103
Utilities Pwr. & Lt., com. A $2.	*m* 31½	28½	34½
Utilities Pwr. & Lt., com. B $1—no par	*k* 29¾	18½	29¾
VERMONT HYDRO-ELEC., 7% pf.	100	95	102
Virginia Elec. & Pwr., 7% pf.	*k*110½	108	111
Virginia Public Service 7% pf.	102½	97	103
WAGNER ELEC., 7% pf.	*o*101½	96½	102
Wagner Elec., com.—no par	*b* 62½	37	60
Washington Ry. & Elec., 5% com.	*j*485	....	....
Washington Ry. & Elec., 7% pf.	*j*102½	....	....
Washington Wtr. Pwr., 8% com.	227	175	235
West Penn Elec., 7% pf.	114½	109½	114½
West Penn Elec., Cl. A $7.	111½	106½	112
West Penn Pwr., 7% pf.	115½	114½	117
West Penn Pwr., 6% pf.	109½	108½	113
West Virginia Lt., Ht. & Pwr., 7% pf.	95	94	100
Western Pwr., 7% pf.	104	103	104½
Western States Gas & Elec., 7% pf.	102	100	106
Western States Gas & Elec., com.	38	....	....
Westinghouse Elec. & Mfg., 8% com.—50	105½	88½	112
Weston Elec. Instrument, Cl. A $2—no par	*k*33½	30½	34½
Weston Elec. Instrument, com.—no par	16½	12½	17½
Wheeling Elec., 6% pf.	106	95	104
Worthington Pump, 7% pf. A.	*k* 55	46½	55
Worthington Pump, 6% B.	45½	41	49½
Worthington Pump, com.	31½	28	34½
YALE & TOWNE com. $5—25.	72½	68½	75

Stock Exchange: *a*Chicago; *b*St Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, April 14. *l*Bid price Wednesday, April 18. *m*Latest quotations available. †Dividend rate variable.

Samuel T. Bodine, Arthur W. Thompson, Paul Thompson, J. E. Zimmermann, Thomas N. McCarter and Percy S. Young. These men, all prominent in public utility circles, are on the directorate of the United Engineers & Constructors, Inc., organized early this year.

CINCINNATI STOCKHOLDERS APPROVE CONSOLIDATION. — Stockholders of the Cincinnati Gas & Electric Company have approved the consolidation of their company and the Columbia Power Company into a new corporation named the Columbia Gas & Electric Corporation. They will exchange their $100 par stock on an even basis for 5 per cent preferred stock of the new corporation, as announced previously in the ELECTRICAL WORLD.

ALLIS-CHALMERS INCREASES CAPITAL. —The Allis-Chalmers Manufacutring Company is planning to increase its authorized capital stock to $50,000,000 from $26,000,000. A meeting of stockholders to vote on the proposed increase has been called for May 3. It is not contemplated that any portion of the proposed additional stock will be issued at this time, but directors deem it advisable to have such unissued stock available for possible requirements in connection with future expansion and development.

AMERICAN ELECTRIC POWER INCREASES STOCK.—The American Electric Power Corporation has filed a certificate at Dover, Del., increasing its authorized capital stock (no-par value) from 415,000 shares to 515,000 shares.

CONNECTICUT COMPANY TO CHANGE SET-UP.—President Samuel Ferguson's recommendation to increase the capital stock of the Connecticut Power Company and reduce the par value of the stock was recently approved by the directors. A stockholders' meeting early in May is expected to provide for a capital increase of $3,000,000. New shares will then be issued in the ratio of one for five at par and the par value reduced from $100 to $25. At first it is planned to increase the capital from $5,800,000 to $7,000,000. This is an increase of $1,200,000, and the balance of the proposed $3,000,000 capital increase will be authorized for any future circumstances that may arise. This action is to provide for the acquisition of shares of the Union Light & Power Company, Unionville, Conn., and the

$25 par value will make a wider distribution of stock possible. It will also be in line with the reduction of par value made by the Hartford Electric Light Company, a closely allied company.

Standard Gas to Change Set-Up

Stockholders of the Standard Gas & Electric Company will be asked to vote May 16 on a proposal to change the 500,000 shares of 7 per cent prior preference stock of $100 par value to 750,000 shares of no-par prior preference stock. A change in the authorized amount of 8 per cent cumulative preferred stock from 600,000 shares of $50 par value to 1,500,000 shares without par value will also be considered.

New Capital Issues

The largest electric light and power issue of the year was offered by the Associated Gas & Electric Company in the form of convertible 4½ per cent gold debentures, a piece of financing involving a total of $63,000,000. Proceeds will be used to retire debentures outstanding and securities of subsidiaries, for the acquisition of property and for other corporate purposes.

A ten-million-dollar issue was offered by the Shawinigan Water & Power Company in the form of first mortgage and collateral trust sinking fund gold bonds, priced at 98½ and accrued interest, yielding about 4.60 per cent.

During the week ended April 19 the Central States Electric Corporation issued 6 per cent cumulative preferred stock to the amount of $10,000,000 at 101 a share and accrued dividend, to yield 5.94 per cent. Each certificate, representing preferred stock, will carry a stock purchase warrant (non-detachable prior to Nov. 1, 1928) entitling the holder, subject to the provisions of resolutions to be adopted by the directors authorizing the issue of such warrants, to purchase from the Central States Electric Corporation on or before May 1, 1933, one share (without par value) of common stock of the North American Company for each share of preferred stock.

ENGINEERS PUBLIC SERVICE INCREASES COMMON.—Stockholders of the Engineers Public Service Company, at a special meeting held April 12 at Wilmington, Del., voted to increase the authorized common stock from 1,500,000 to 3,000,000 shares, of no par value, and approved amendments to the charter permitting consummation of the $35,000,000 refinancing plan proposed by the directors. Under this plan all of the company's $7 dividend no par preferred stock will be called and replaced by an issue of $5 dividend convertible preferred stock. The directors, meeting at New York after the stockholders' action, voted to call the $7 dividend preferred stock on July 1 at 110 and accrued dividends. There are 310,468 preferred $7 dividend and 797,240 common shares now outstanding.

AMERICAN SUPERPOWER WILL PAY STOCK DIVIDEND.—The directors of the American Superpower Corporation declared a stock dividend to holders of class A and class B common shares of record April 23, consisting of one share of preference stock for each five shares of common stock held. This declaration of the directors followed authorization by the stockholders of the corporation of an issue of 400,000 shares of no-par $6 cumulative preference stock.

BALTIMORE STOCKHOLDERS APPROVE INCREASE IN CAPITAL STOCK.—Stockholders of the Consolidated Gas, Electric Light & Power Company of Baltimore approved the proposed increase in total capital stock to 1,500,000 shares from 1,450,000 shares, the additional 50,000 shares to be classified as 5 per cent series A preferred. They also authorized the directors to issue any number of shares of stock of one or more classes from time to time as the directors deem advisable.

Cities Service Plans $50,000,000 Loan

With the purpose of refunding outstanding securities and enlarging the company's activities Cities Service Company is planning a fifty-million-dollar issue of 5 per cent debentures, one of the largest pieces of public utility financing of the year. Public offering of the issue is expected within a few days.

KANSAS CITY COMPANY INCREASES CAPITAL.—At the recent annual meeting of the stockholders of the Kansas City Power & Light Company the board of directors was authorized to increase the common stock of the company from 350,000 to 600,000 shares.

Utilities Well Represented on New Legal Bond List

The securities listed below have qualified as legal investments for savings banks and trust funds in New York State, according to the tentative list issued by F. H. Warder, Superintendent of Banks.

ALABAMA POWER—1st mtge. lien & ref. 5s, 1951; 5s, 1956; 1st mtge. 5s, 1946; 1st & ref. 4½s, 1967.
BLACKSTONE VALLEY GAS & ELECTRIC—1st & gen. 5s, 1939.
BROOKLYN EDISON CO.—Edison Elec. Illum. 1st cons. 4s, 1939; Kings County Elec. Light & Pr. 1st 5s, 1937, and 6s, 1997; Brooklyn Edison A 5s, 1949, and B 6s, 1930.
BUFFALO GENERAL ELECTRIC—1st 5s, 1939; 1st ref. 5s, 1939; gen. & ref. 5s, 1956.
CENTRAL MAINE POWER—1st 5s, 1939; 1st & gen. 5½s, 1949; 5s, 1955, and 4½s, 1957.
CLEVELAND ELECTRIC ILLUMINATING—1st 5s, 1939; general 5s, 1954 and 1961.
CONNECTICUT POWER—1st and cons. 5s, 1963.
CONNECTICUT LIGHT & POWER—1st & ref. 7s, 1951; 5½s, 1954, and 4½s, 1956.
CONSOLIDATED GAS OF BALTIMORE—United Elec. Light & P. 1st 4½s, 1929; Cons. Gas of Balt. 1st 5s, 1939, and 1st 4½s, 1954; Cons. Gas, Elec. L. & P. gen. 4½s, 1935; 1st ref. 6s, 1949; 5s, 1965 and 5½s, 1952.
CONSUMERS POWER—Michigan Light 5s, 1946; Consumers 1st ref. 5s, 1936; 1st unif. 5s, 1952; 5½s, 1954.
DETROIT EDISON—1st 5s, 1933; Eastern Mich. 5s, 1931; Det. Edison 1st & ref. 5s, 1940; 6s, 1940; gen. & ref. 5s, 1949; 5s, 1955; 5s, 1962.
DUQUESNE LIGHT—1st 4½s, 1967.
ERIE COUNTY ELECTRIC—Cons. 6s, 1959; gen. & ref. 5½s, 1960.
HARRISBURG LIGHT & POWER—1st 5s, 1952.
INDIANA & MICHIGAN ELECTRIC—1st 5s, 1957; 1st and ref. 5s, 1955.
KANSAS CITY POWER & LIGHT—1st mortgage 5s, A, 1952, 4½s, B, 1957.
LOS ANGELES GAS & ELECTRIC—Gen. 5s, 1934; 1st & ref. 5s, 1939; gen. & ref. Series D-1, 5½-6s, 1942-49; 1st & gen. 5s, 1961.
METROPOLITAN EDISON CO.—York Haven Water & Power Co. 1st 5s, 1951; Metro. Edison 1st & ref. 5s, 1953; Metro. Edison 1st 4½s, 1968.
NEBRASKA POWER—1st 5s, 1949; 1st 6s, 1949.
NEW JERSEY POWER & LIGHT—1st 5s, 1956.
NEW YORK EDISON—New York Gas, Elec. Light, Heat & Power 1st 5s, 1948; purchase money 4s, 1949; Edison Elec. Illum. 5s, 1995; New York Edison 1st & ref. 6½s, 1941, and 5s, 1944.
NEW YORK & QUEENS ELECTRIC LIGHT & POWER—1st 5s, 1930.
NIAGARA FALLS POWER—Hydraulic Pwr. of N. F. 1st & ref. 5s, 1950; ref. & imp. 5s, 1951; Niagara Falls Pwr. 1st 5s, 1932; ref. & gen. 6s, 1932; 1st & cons. 6s, 1950.
NORTHERN INDIANA PUBLIC SERVICE—1st & ref. 5½s, 1960; 5s, 1966; Northern Indiana Gas & Electric 1st lien & ref. 6s, 1952, and 5s, 1929; Indiana Lighting 4s, 1958.
PACIFIC GAS & ELECTRIC—Divisional bonds, gen. & ref. 5s, 1942; 1st & ref. 4½s, 5s, 5½s and 6s, Series B-E.
PACIFIC POWER & LIGHT—1st & ref. 5s, 1930.
PHILADELPHIA ELECTRIC—1st s. f. 4s & 5s, 1966; 1st & ref. 5½s, 1947; 5½s, 1953; 5s, 1960; 4½s, 1967.
PHILADELPHIA SUBURBAN COUNTIES GAS & ELECTRIC—P. S. G. & El. 1st & ref. 5s, 1960; cons. 6s, 1943; 5½s, 1955; P. S. C. G. & El. 1st ref. 4½s, 1957.
PUBLIC SERVICE ELECTRIC AND GAS (N. J.)—United Electric 1st 4s, 1949; Public Service Electric and Gas 1st and ref. 5s, 1965 and 4½s, 1967.
PUBLIC SERVICE COMPANY OF N. H.—1st and ref. 5s, 1956.
QUEENS BOROUGH GAS AND ELECTRIC—Gen. 5s, 1952; ref. 6s, 1953; ref. 6s, 1955.
ROCHESTER GAS AND ELECTRIC—Municipal Gas and Elec., 1st 4½s, 1942; Rochester Ry. and Lt. 5s, 1954; Rochester Gas and Elec. gen. 7s, 1946; 5½s, 1948; 4½s, 1977.
SAN DIEGO CONSOLIDATED GAS AND ELECTRIC—1st 5s, 1939; 1st and ref. 6s, 1939; 5s, 1947; 6s, 1947.
SOUTHERN CALIFORNIA EDISON—Mt. Whitney Power and Elec. 6s, 1939; Pacific Light and Pwr. 1st 5s, 1942; 5s, 1951; Southern California Edison gen. 5s, 1939; gen. and ref. 5s, 1944; 5½s, 1944; ref. 5s, 1951; 5s, 1952.
SYRACUSE LIGHTING—Syracuse Gas 1st 5s, 1946; Lighting 1st 5s, 1951; 1st and ref. 5½s, 1954.
TOLEDO EDISON—Toledo Gas, Elec. and Heating 1st 5s, 1935; Toledo Edison 1st 5s, 1947.
TWIN STATE GAS AND ELECTRIC—1st and ref. 5s, 1953; 5½s, A, 1945.
UNION ELECTRIC LIGHT AND POWER (MO.)—1st 5s, 1932; ref. and ext. 5s, 1933; gen. A 5s, 1954; B 5s, 1967.
UNITED ILLUMINATING (CONN.)—1st 4s, 1940.
UTICA GAS AND ELECTRIC—Equitable Gas and Electric 5s, 1942; Utica Gas and Elec. ref. 5s, 1957; gen. 5½s, 1949; 5s, 1956.
WEST PENNSYLVANIA POWER—1st mortgage, Series A 5s, 1946; E 5s, 1963; F 5½s, 1953; G 5s, 1956.
WESTERN NEW YORK UTILITIES—1st 5s, 1946.
WHEELING ELECTRIC—1st 5s, 1941.
WISCONSIN GAS AND ELECTRIC—1st 5s, 1952.

Business News and Market Conditions

First Quarter Contracts Increase 25 per Cent

Increases Reported from All Sections—Contracts 41 per Cent Greater than in February and 38 per Cent More than in March, 1927.

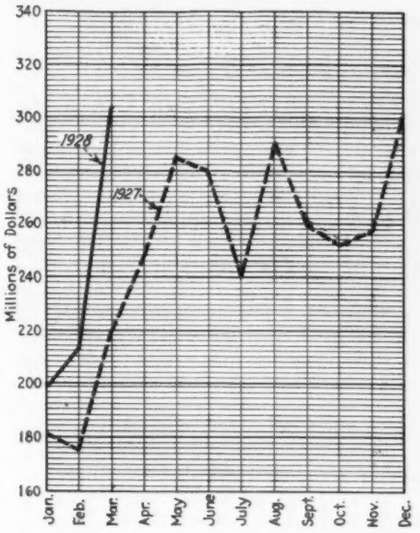
EVERY section of the country showed a gain in engineering construction contracts during March when compared with average weekly figures for February. Increases ranged from 97 per cent in New England to 11 per cent in the South. Compared with a year ago, March totals showed increases in all sections, except west of the Mississippi, where a 15 per cent decline was recorded. Contracts reported by the *Engineering News-Record* during the five weeks of March, 1928, totaled $379,521,000.

The outstanding feature in the awards let during March, 1928, was the large commercial building total for the Middle Atlantic states. This value, $113,428,000, constituted 30 per cent of the total awards. The average monthly commercial awards in that section during 1926 were $40,335,000, in 1927 $52,440,000 and thus far in 1928 $72,300,000. Several of the large March contracts were: In New York, office and store, $23,000,000; office and printing, $6,000,000; apartment hotel, $6,000,000; in Chicago, office and printing, $10,000,000; theater and office, $20,000,000; club, office and store, $4,000,000. There were 25 commercial building awards outside of New York City that exceeded $1,000,000, and these totaled $32,650,000. New York commercial awards totaled $81,451,000 and Illinois awards totaled $43,236,000.

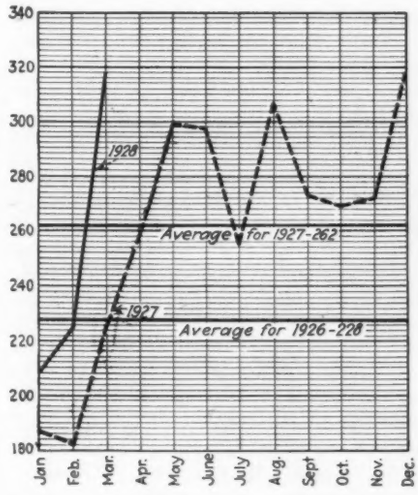
Total private awards for March, 1928, exceeded those of a year ago by 56 per cent, whereas only an 8 per cent increase is shown in public contracts. The summer months are peak months for public awards because of the large volume of street and road work, which thus far in 1928 constitutes 47.5 per cent of all public contracts. Public contracts in 1928 and 1927 to date respectively are $241,748,000 and $205,171,000.

The construction volume index number for March is 318. This compares with 228 for the whole of 1926, 262 for all of 1927 and 100 for 1913. This means that the actual volume of contract letting in March, 1928 (not the mere money value of the contracts let), is 218 per cent greater than the volume for 1913. The index number contains the increment of construction and indicates the rate at which contracts are let, as compared with 1913 awards.

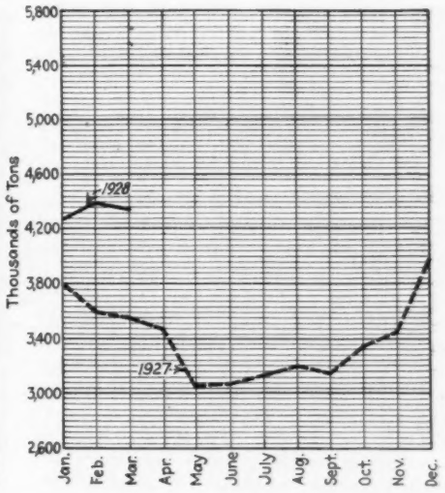
Unfilled orders of the United States Steel Corporation showed a decrease in March. The trend in 1927 and to April 1, 1928, is indicated in the accompanying curve. The decrease was smaller than anticipated and indicates increased buying late in March.



Contracts awarded in United States



Construction volume as compared with an index of 100 for 1913



Unfilled tonnage as reported by the United States Steel Corporation

In the chart at the left the actual volume of construction is compared and not the mere money value of contracts let. (*Engineering News-Record* statistics.)

Value of Contracts Let in the United States and Canada During March, 1928

Thousands of dollars (000 omitted)

	New England	Middle Atlantic	South	Middle West	West of Mississippi	Far West	United States	Jan. 1 to Date, U. S.	Canada
Waterworks	.....	$567	$148	$623	$899	$466	$2,703	*87,365*	$144
Sewers	.....	1,208	201	3,999	996	1,765	8,169	*13,120*	253
Bridges	$288	2,190	153	2,112	2,289	524	7,556	*22,623*	500
Excavation, drainage, etc	25	137	52	245	126	34	619	*4,225*	259
Streets and roads	222	8,163	6,155	15,103	17,300	5,023	51,966	*114,993*	10,488
Industrial building	6,616	8,635	10,860	7,288	4,510	2,642	40,551	*79,914*	640
Commercial building	14,899	113,428	7,491	59,392	15,265	21,756	232,231	*462,296*	3,610
Federal government	.....	3,650	459	64	1,485	646	6,304	*12,248*	.....
Unclassified	140	7,629	946	1,202	11,183	8,322	29,422	*74,011*	6,500
March, 1928	22,190	145,607	26,465	90,028	54,053	41,178	379,521	.....	22,394
February, 1928	9,020	84,820	18,962	45,281	34,706	20,501	213,290	.....	4,744
March, 1927	21,984	84,256	16,769	56,944	63,304	30,181	273,438	.....	5,309
Year to date, 1928	*48,550*	*303,231*	*64,504*	*175,589*	*120,440*	*78,481*	.....	*790,795*	*39,713*
Year to date, 1927	50,446	178,076	50,493	142,880	117,868	90,685	.....	630,448	13,931

NOTE.—Owing to five weeks of construction contracts being included in some months, as in March, the figure for the total contracts let, as shown in the table, does not agree with the figure as represented in the curve. In order to obtain comparable figures the curve is worked out on a four-week basis for each month.

Market Conditions

IN NEW ENGLAND central-station companies are prominent buyers. Insulator sales in that district were reported at a peak last week. Small motor sales reached a total of over $50,000. Good central-station buying continues in the Eastern district. Prime movers are in demand. Sales include a 5,000-kw. unit, costing $55,000, for northern New York and a 70,000-kw. unit, costing $750,000, for a Middle West company. A metropolitan central-station company also bought $50,000 worth of transformers. Railway business is beginning to loom as an active factor in the market.

Large power equipment orders are anticipated in the Southeast. One company plans the immediate purchase of $1,000,000 worth of generating equipment. A steel mill in Alabama purchased $45,000 worth of motors and an iron mill in the same state ordered $20,000 worth of automatic substation equipment. In St. Louis manufacturers report the demand for motors and equipment above normal. A slight increase in business is noted in the Middle West, with industrial activity somewhat spotty. On the Pacific Coast power company buying is fair and street-lighting sales are active.

Central Stations Prominent in New England Buying

Sales of electrical equipment in the New England district have continued with encouraging signs of activity. Central-station needs have added vigor to the market. Many small orders were reported. Bus supports, disconnecting switch orders, small switches, outside requirements, insulators, cable and wire were in good demand. A prominent manufacturer reports insulator sales at a peak during the past week. Orders for general replacement equipment included one for an eastern Massachusetts substation for $2,000 and another for a central-station company in Maine for $1,500. One of the largest manufacturers in the district records a steady gain in inquiries. Small motor sales reached a total of over $50,000. A few large motors were ordered during the week.

Heavy industrial equipment sales are quiet, but indications point to a number of interesting orders that will be placed shortly. The plans for the addition to the Edgar station include provisions for a 10,000-kw. turbo-generator unit as well as two high-pressure boilers rated 1,400 lb. per square inch. Construction projects are as follows:

The Public Service Company of New Hampshire, Manchester, plans to construct interconnecting lines, one of 66,000 volts connecting the Griggs Falls plant with Nashua and a 33,000-volt line connecting Henniker with Hillsborough. The Randolph and Holbrook Power & Electric Light Company, Randolph, Mass., is planning to build a substation in Holbrook, Mass. Springfield, Mass., has authorized $234,000 for an electric pumping plant for municipal water works.

Large Power Equipment Order Expected in Southeast

No purchases out of the ordinary are reported for central-station companies in the Southeast. One company ordered fiber conduit amounting to $6,700, aluminum cable totaling $2,100 and creosoted pine poles valued at $4,300. An order approximating $30,000 for cotton gin motors for a Mississippi power company is in immediate prospect and will probably be placed this week. An Alabama power company has asked for bids on three waterwheels and generators, with a total capacity of 90,000 kva., and contracts will probably be let the early part of May.

Construction contracts have been let on the two new viaducts in Atlanta and the sub-contract on electrical work will undoubtedly be let within the very near future. The electrical materials required on this project will total about $35,000. Bids are in on school building construction amounting to about $1,000,000 in Atlanta and contracts are to be let this week.

A steel mill in Alabama that is revamping its plant ordered motors amounting to $45,000 and an iron mill in the same state ordered $20,000 worth of automatic substation equipment. A cotton mill in the Carolinas ordered motor equipment costing $2,500. Purchases by contractors are slow, such orders as are being received coming from the larger contracting firms. One contractor ordered $6,000 worth of wiring materials for one job in middle Georgia. Construction projects are as follows:

The Erwin Manufacturing Company, Huntsville, Ala., plans addition to textile mill, to cost $100,000. The Columbus Electric & Power Company, Columbus, Ga., is planning hydro-electric power plants on the Chattahoochee River, near Maple Creek and Harrison Island, respectively, to cost $1,000,000. The Lindsay-McMillan Company, Milwaukee, Wis., plans an oil refining plant near Savannah, Ga., to cost $150,000. Rolling Fork, Miss., will receive bids May 1 for equipment for municipal power plant. Columbia, N. C., is asking bids until May 7 for equipment for municipal lighting plant. Shelby County Commissioners, Memphis, Tenn., plan mechanical shops for the County Workhouse, to cost $400,000. Union City, Tenn., plans early installation of a 1,000-kw. turbo-generating unit. The American Creosoting Works, Inc., Norfolk, Va., plans a creosote distilling plant, to cost $150,000. The Gauley Power Company, Charleston, W. Va., plans a 60,000-hp. hydro-electric power plant on the Gauley River in Fayette County, to cost $900,000. Martinsburg, W. Va., plans a municipal power plant. Hazelhurst and Meridian, Miss., will install ornamental lighting systems.

Prices Continue Firm in Dull Metal Markets

Absence of buying interest accompanied by unchanged or, in some cases, slightly higher prices, featured the nonferrous metal markets during the week ended Wednesday. Lead has been quiet

NEW YORK METAL MARKET PRICES

	Apr. 11, 1928 Cents per Pound	Apr. 18, 1928 Cents per Pound
Copper, electrolytic	13.9625	13.9875
Lead, Am. S. & R. price	6.10	6.10
Antimony	9.625	10.00
Nickel, ingot	35	35.00
Zinc spots	6.075	6.10
Tin, Straits	51.875	52.50
Aluminum, 99 per cent	24.30	24.30

Base copper wire price April 18, 1928, 16 cents.

but steady at 6.10 cents, New York, and 6 cents, St. Louis; some activity is reported in tin at slightly better prices and the tone of the domestic zinc market is better as a consequence of some improvement in prices in London. And mony quotations are fractionally higher.

Good Central-Station Buying in Eastern District

Power company business is a feature of current business in the Eastern district, not only with regard to actual contracts but in connection with inquiries for early commitment. Prime movers are again in demand, with substation equipment and line materials close seconds in volume sales. The outlook for continuance of the present buying movement is decidedly encouraging. A central-station company in northern New York has placed an order for a 5,000-kw. turbo-generator, with accessories, totaling about $55,000 and a Middle West power company has contracted for a 70,000-kw. unit of like type with the same manufacturer, the order aggregating $750,000. An order for transformers has been given by a metropolitan central-station company to an amount which will be approximately $50,000.

A New York company has secured an order for the steam end of a municipal power station project in Missouri, covering boilers, stokers, forced draft equipment, etc., amounting to $30,000. The contract for the turbo-generator installation for the same plant in Missouri has been given to a Pittsburgh manufacturer at $41,000. Control apparatus for central-station service is in improved demand, following rather spotty conditions for several weeks past. A leading maker has secured a contract for equipment of this kind for a New York power station, costing approximately $60,000.

Railway business is beginning to loom as an active factor in the market. Actual buying is expected to mature within the next four to six weeks. It is anticipated that the New York Central Railroad Company will be in the market for equipment for the electrification of its west side lines in New York at an early

date. The decision of the Pennsylvania Railroad Company to expend $20,000,000 for a new passenger terminal and line improvements at Newark, N. J., is another project of particular importance. Immediate construction activities in the Eastern district include the following:

The United Electric Light & Power Company, New York, plans for a distributing plant on 134th Street to cost $60,000. The LaClede Company, Buffalo, N. Y., will build an addition to its paper and card factory to cost about $100,000. The Signal Corps Laboratory, Fort H. G. Wright, N. Y., is asking bids until April 30 for 16,000 ft. of submarine cable (Circular 4). The Royle & Pilkington Company, Mount Holly, N. J., plans a new textile mill at Hazlewood, N. C., to cost $125,000. The Roller Bearing Company of America, Inc., Newark, N. J., has acquired the former plant of the Mercer Motor Car Company, Trenton, N. J., and will remove and expand its works at a cost of $350,000. The Bureau of Water, Philadelphia, Pa., is asking bids until April 26 for switchboards, electrical instruments, etc., for the Belmont pumping station (Contract No. 917); also, at same time for motor-driven pumping machinery (Contract No. 916).

The Baltimore & Ohio Railroad Company will make extensions in shops at New Castle, Pa., to cost $150,000. Washington and Jefferson College, Washington, Pa., plans a two-story chemistry building to cost $225,000. The Philadelphia Suburban-Counties Gas & Electric Company will install a power switching station at Bridgeport, Pa., in connection with service from the Conowingo hydro-electric power project. The Board of District Commissioners, Washington, D. C., is asking bids until April 25 for motors, starting equipment, etc., in connection with pumping machinery for the municipal sewage system. The General Purchasing Officer, Panama Canal, Washington, is asking bids until April 27 for dome refractors, electric refrigerators, etc. (Panama Schedule 1870.)

Street-Lighting Sales Active on Pacific Coast

Recent power company orders on the Pacific Coast include one carload of 60,000-volt pin-type insulators for $8,000 and one carload of 11,000-volt units for $3,500, both for installation along the central area of the Coast range. A contract placed by Truckee for installation of a light, heat and power system amounted to $9,372. The power company load drive is reflected in a San Francisco jobber's purchase of 210 ranges, valued at $22,500, for stock.

Street-lighting business amounted to nearly $30,000. An order for 51 assorted motors, from 5 hp. to 150 hp. and valued at $15,000, has been placed for Hawaiian shipment. Prospective business includes complete electrical equipment for the Oakland Estuary subway, airway beacons and landing equipment for all the emergency fields on the airway routes between San Francisco and Blue Canyon and San Francisco and Redding, a $500,000 oil distributing plant in San Jose for a Doheny subsidiary, a $2,000,000 expenditure by San Francisco for new firehouses and high-pressure extensions, a 10-mile pole line job for Stanford University, a 45-mile farmers' telephone line for Raymond and a 15-mile similar line for Lemoore, a $2,000,000 factory and plant for Johns-Manville at Pittsburg, Calif., and a $1,000,000 hotel and bungalow colony near Indio on the edge of the California desert.

Sales of motors and pumps for orchards and irrigation districts in eastern Washington continue exceptionally brisk. Other motor business is quiet. Range sales reported average about 750 per month in Seattle alone and domestic appliances are in good demand. Specifications are reported out for approximately 50 motors, 25 hp. to 15 hp., for an Idaho lumber mill and for 30-in. butterfly valves, pumps and motors for a pumping plant for the U. S. Indian Irrigation Service at Wapato.

The city of Seattle is taking bids for 175,000 ft. of guy wire and 10,000 eight-pin cross-arms. The Mountain States Power Company, Tacoma, Wash., plans an expenditure in excess of $100,000 in improvements to light and power service in Coos Bay, Ore. The Northwestern Pulp & Paper Company is reported to have signed a contract with the Austin Company for a 100-ton pulp mill at Astoria, Ore. Construction projects are as follows:

The Willys-Overland Company, Toledo, Ohio, will build an assembling plant at Los Angeles, to cost $1,000,000. The Floco Motors Corporation, Los Angeles, Calif., recently organized, plans an automobile manufacturing plant to cost $150,000. The Continental Can Company, San Francisco, Calif., plans a new plant at Sacramento, to cost $1,000,000, and the California Co-operative Producers, Inc., Oakland, will build a canning plant on adjoining site, to cost $350,000. The Pacific Lumber Company, Scotia, Calif., plans a pulp and paper mill, to cost $500,000. The Pacific Power & Light Company, Portland, Ore., will extend transmission lines in the Lewiston-Clarkston and Idaho district, to cost $90,000. Santa Barbara, Salinas, Calif., and Santa Paula, Calif., plan ornamental lighting systems.

Power Company Buying Active in St. Louis District

All manufacturers in the St. Louis district report the demand for small industrial motors and equipment above normal. One lot of $1,000 worth of motors was shipped to the lead district, another lot of 21 small motors was sold to a refining company for $2,000. A large power company is making extensive changes in its power plants at a cost estimated at over $1,250,000. Orders have already been placed for more than one-half of the needed equipment. Construction projects are as follows:

The Arkansas Portland Cement Company, operated by the Oklahoma Portland Cement Company, Ada, Okla., plans a new mill near Schaal, Ark., to cost $1,000,000. The Century Electric Company, St. Louis, Mo., plans a new plant unit to cost $200,000. The Benton County Utilities Corporation, Gentry, Ark., plans transmission lines at Springtown, Ark. The Southwestern Light & Power Company, Oklahoma City, Okla., plans a transmission line from Comanche to Addington, Okla. The Southwestern Light & Power Company, Oklahoma City, Okla., has acquired the municipal power plant at Eric, Okla. The West Texas Utilities Company, Abilene, Tex., plans a transmission line to Eden, Tex. The Texas Gulf Power Company has acquired the municipal power plant at Strawn, Tex.

Slight Increase Noted in Middle West

There has been a slight increase in the volume of business transacted in the Middle West and the employment situation has improved a trifle. The steel, automobile and electrical industries apparently are operating with a substantial volume of business. Industrial activity is somewhat spotty. An interesting report made public this week of the location of the Wireless Dry Cells, Ltd., an Eastern dry cell manufacturer, in the Chicago clearing industrial district, states that this firm will give employment to 400 to 500 workers and is the 87th firm to locate in this district and the fifth firm this year.

The various utility companies are proceeding with spring construction work and a considerable amount of apparatus purchasing is reported. Among the interesting orders placed this week were one for a 40,000-kw. frequency changer, valued at $350,000, and two others for labor and material to construct a substation, at a cost of $145,000. Jobbers' sales continue to show improvement. Motor sales have increased somewhat and considerable building business is being obtained. Construction projects are as follows:

The Midwest Rubber Reclaiming Company, Monsanto, Ill., plans a one-story plant to cost $150,000. The Northwestern Light & Power Company, Cedar Rapids, Iowa, plans improvements in power plant at Peterson, Iowa, to cost $65,000. The General Motors Corporation, Detroit, plans a seven-story research laboratory to cost $250,000. The AC Spark Plug Company, Flint, Mich., will build a three-story addition, to cost $100,000. The Michigan School for the Blind, Lansing, Mich., plans a new power plant to cost $100,000. The Monroe Auto Equipment Company, Monroe, Mich., plans a factory addition to cost $150,000.

The Firestone Tire & Rubber Company, Akron, Ohio, plans a two-story factory branch plant at Columbus, Ohio, to cost $125,000. The Standard Electric Stove Company, Toledo, Ohio, plans a new plant, to cost $150,000. The Carnegie Steel Company plans an addition to its McDonald mill, Youngstown, Ohio, to cost $1,000,000. The Wisconsin Power & Light Company, Madison, Wis., plans rebuilding of power dam and hydro-electric power plant at Necedah, Wis. The Lake Superior District Power Company, Ironwood, Mich., has secured a franchise for a transmission line from Wakefield to Thomaston. The Dayton Power & Light Company, Dayton, Ohio, plans transmission lines in Piqua, Ohio, and Covington, Ky., districts, to cost more than $500,000; also plant improvements and extensions at Dayton. The Lake Superior District Power Company, Ashland, Wis., plans a transmission line from its White River plant to Mason and Benoit Wis. Elgin, Ill., and Benton, Wis., plan ornamental lighting systems.

Activities of the Trade

Westinghouse Gets Large Power Equipment Order

The Duke Power Company, Charlotte, N. C., has awarded a contract to the Westinghouse Electric & Manufacturing Company for two 60,000-kw. steam turbo-generator units for the Riverbend power plant. The contract involves more than $1,250,000. The first unit of the equipment will be delivered April 1, 1929, and the second on May 1, 1929. The Riverbend steam plant of the Duke Power Company, preliminary work on which is already under way, is occupying a site on the Catawba River, 12 miles from Charlotte. A possible eventual installation of 450,000 kw. in this plant is announced.

THE OLIVER IRON & STEEL COMPANY, Pittsburgh, announces that Bertram Quarrie has been elected president of the company to succeed Henry Oliver, who has resigned. Mr. Quarrie was formerly connected with the American Steel & Wire Company and the Otis Steel Company at Cleveland.

THE C. O. BARTLETT & SNOW COMPANY, Cleveland, manufacturer of material handling equipment, announces the appointment of W. H. Norrington as its representative in New York City and vicinity with headquarters at 30 Church Street.

THE J. LEO SCANLON COMPANY, Buffalo, N. Y., manufacturers' agent, announces that Vincent J. Brown is now associated with the company as a sales representative.

THE DAMPNEY COMPANY OF AMERICA, Hyde Park, Boston, announces that the sale of its "Apexior" protective coatings for power plant equipment will be handled in southern Minnesota by the Kent Engineering Company, 732 Builders Exchange, Minneapolis, Minn.

THE EDISON ELECTRIC APPLIANCE COMPANY, INC., 5600 West Taylor Street, Chicago, announces a reduced price on its "Hotpoint" model R 6-lb. laundry iron. Price reductions also have been announced on other standard "Hotpoint" irons.

THE IDEAL COMMUTATOR DRESSER COMPANY, Sycamore, Ill., announces the appointment of the Syracuse Supply Company, 314 West Fayette Street, Syracuse, N. Y., as its sales representative for the sale of Ideal commutator resurfacers and other maintenance equipment in the Syracuse territory.

THE FEDERAL GAUGE COMPANY, 564 West Adams Street, Chicago, announces the organization of the Mercoid Corporation to become the operating unit of the company. The Federal company also controls the Mercoid Corporation and the Arcless Contact Company, a controlling interest in which has just been acquired. General offices will be maintained at and correspondence for any of these three companies should be addressed to 564 West Adams Street, Chicago.

EDWARDS & COMPANY, INC., 140th and Exterior Streets, New York City, manufacturer of electric signaling devices, announces several additions and changes to its line of electric signaling devices. The company also has appointed Walter I. Ferguson & Company as representative in Kansas City, 208 Baltimore Building, and in St. Louis, 1486 Arcade Building.

THE NATIONAL FLUE CLEANER COMPANY, Groveville, N. J., manufacturer of soot blowers for fire tube boilers, announces the appointment of the Naylor-Hickey Corporation, 643 Washington Boulevard, Chicago, as its Chicago representative and the Furnace Improvement Company, 511 Westminster Street, Providence, R. I., as its New England representative.

THE BENJAMIN ELECTRIC MANUFACTURING COMPANY, 120 South Sangamon Street, Chicago, has placed on the market a gymnasium fixture consisting of a heavy gage steel canopy and wire guard and RLM standard dome reflector, a ball fixture aligner and an intensifier, a supplementary lighting unit for special operations, where in addition to good general illumination it is desirable to concentrate an intense light on certain small areas.

THE AMERICAN BROWN BOVERI ELECTRIC CORPORATION, Camden, N. J., has received an order from Anderson, Ind., for a 10,000-kw. steam turbine for the municipal power plant.

THE BELDEN MANUFACTURING COMPANY, Chicago, manufacturer of insulated wires and cables, plans a second unit for its plant at Richmond, Ind.

THE SIMPLEX WIRE & CABLE COMPANY, Cambridge, Mass., has awarded a contract to Stone & Webster, Inc., Boston, for a one-story addition to its plant on Franklin Street.

THE EUREKA VACUUM CLEANER COMPANY, Detroit, announces a new model 11 Eureka combination home and automobile cleaner with detachable handle.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has appointed the Times Appliance Company, Inc., 33 West 60th Street, New York City, and 166 Atlantic Avenue, Brooklyn, N. Y., as its agent jobber in the Metropolitan district exclusive of New Jersey. This company, of which E. B. Ingraham is general manager, has been for seven years a special jobber for the Westinghouse company. The officers are E. A. Allen, president; B. A. Allen, vice-president, and E. B. Ingraham, secretary and treasurer.

General Electric Orders Increase 3 per Cent

Orders received by the General Electric Company for the first three months of this year amounted to $79,925,840, President Gerard Swope has announced. This compares with $77,550,581 for the corresponding quarter in 1927, an increase of 3 per cent, and with $86,433,658 for the first quarter of 1926.

THE TRUMBULL-VANDERPOEL ELECTRIC MANUFACTURING COMPANY, Bantam, Conn., manufacturer of safety switches, etc., announces the opening of a new office in Boston in charge of Frank W. Garner, who has been connected with the New England sales force of the company.

THE ROCKBESTOS PRODUCTS CORPORATION, New Haven, Conn., manufacturer of asbestos covered wires and cables, announces the appointment of C. Dent Slaughter as its Pacific Coast representative, with offices at 314 Twelfth Street, San Francisco; 324 North San Pedro Street, Los Angeles; 200 North Thirteenth Street, Portland, and 1108 Post Street, Seattle.

C. WENDEL MUENCH & COMPANY, 557 West Monroe Street, Chicago, has been organized to serve electrical manufacturers as advertising agents. The organization will specialize in electrical accounts, rendering merchandising direct-by-mail and general advertising service. C. W. Muench, for nine years director of the sales and advertising of George Richards & Company, manufacturers of "Hemco" products, is head of the new organization.

THE W. N. MATTHEWS CORPORATION, St. Louis, manufacturer of electrical specialties and mechanical painting equipment, has added the No. 6 "Xpandix" anchor to its line. This new unit is a two-way expanding type of malleable anchor recommended for 6,000 lb. maximum strain.

THE BUFFALO FOUNDRY & MACHINE COMPANY, Buffalo, N. Y., has acquired the assets, physical properties and patents of the Chemical & Vacuum Machinery Company and will supplement its "Buflovak" and Buflokast" lines of driers and evaporators with several new types. Charles O. Lavett, former general manager, and H. E. Neubauer, former chief engineer of the Chemical & Vacuum Machinery Company, are now associated with the Buffalo Foundry & Machine Company.

COPELAND PRODUCTS, INC., Detroit, manufacturer of electric refrigerators, reports the largest first quarter's shipments in the company's history, with an increase of 45 per cent over the first quarter of 1927.

THE R. THOMAS & SONS COMPANY, East Liverpool, Ohio, manufacturer of porcelain insulators, announces that after May 1 its executive offices will be located at Lisbon, Ohio.

New Equipment Available

Manual A.C. Starter

A manual across the line alternating-current motor starter, the CH-9115, is announced by the Cutler-Hammer Manufacturing Company, Milwaukee. Designed to meet the need for an inexpensive manual starter, it includes overload cutouts giving complete motor protection, cadmium plated, double break, roller type contacts and small size, safety, dustproof inclosing case. The roller type contacts are of the double break type, cadmium plated, and by breaking the arc in two places give several times the life of ordinary contacts. In addition, the contact rollers turn after each operation to present a new contact surface for the next operation.

Complete motor protection is obtained during both the starting and running periods. The thermal overload cutouts provide the necessary time interval to take care of starting inrushes without shutting down the motor. The starter is small and compact, the inclosing case is dustproof and the cover is in two parts. This permits opening the lower section only for replacing fusible links in the thermal overload cutouts. The cover can be opened only when the starter is in the "off" position and all current-carrying parts are dead. Installation can be made without removing the panel from the case. All parts are easily accessible for quick inspection.

Portable Farm Motor

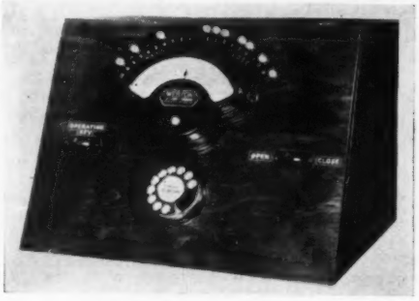
A line of farm "Handi-Motors" consisting of the Wagner air-jacketed (totally inclosed self-ventilated) motor mounted on a portable hand truck has been placed on the market by the Wagner Electric Corporation, St. Louis. Where the air-jacketed motor is not required the regular Wagner open type sleeve motor is supplied. Motors of 2, 3, 5 and 7½ hp., 1,725 r.p.m., 220 volts, single or polyphase are used. The same truck is used for any motor in the line.

PEDESTAL TYPE TRAFFIC SIGNAL.—A pedestal type traffic signal using lights in groups of three each on all four sides, and designed to stand in the center of street intersections, or for mounting on curbs is being marketed by the General Electric Company The new signal differs principally from previous types in the design of the base and the length of the overhead fitting. The new type incorporates a form for the concrete as part of its base, not only saving the time and labor of making a form but also making the signal and base an integral unit and therefore less liable to breakage. The signal may also be obtained in an adjustable form for use at street intersections where the angle of intersection is other than 90 deg. In the adjustable form the signal faces are so arranged that they can be moved to any position, either greater or less than a right angle.

Power Supervisory System

The type E Strowger power supervisory system has been developed by the Electric Power Equipment Corporation, Philadelphia, to meet the needs of comparatively small power installations for a simple method of control and supervision from a distant point. It is said to be particularly suitable where continuous indication is not necessary and where high speed of operation is not important.

The equipment at the substation consists essentially of a switch of the standard Strowger type having a number of semi-circular rows of contacts arranged parallel with each other and in horizontal planes. Associated with each row of contacts is a finger attached to the switch shaft. The shaft and fingers are capable of being moved together, step by step, by means of a magnet, to any desired set of contacts, and may be released from any point by a release magnet which brings the shaft and fingers back to the "home" position. The contact fingers on the switch are of the short-circuiting type, avoiding the use of flexible cords. Each set of contacts is associated with a circuit breaker or other unit to be controlled. The selection of a particular unit by the switch is controlled by the circuit selector at the dispatcher's station.



Dispatcher's control cabinet for power supervisory system

At the substation there is a polarized relay which may be operated in one direction or the other by means of a control key. A number of resistances in the control circuit are so adjusted as to afford a different deflection of the dispatcher's voltmeter indicator. The dispatcher's control cabinet is shown in the illustration. A standard 45-volt dry battery unit supplies current for operating the voltmeter, a 24-volt storage battery is required for operating the switch and relays and a 110-volt alternating-current circuit is used for ringing the alarm. If a unit trips out automatically the alarm will ring. The dispatcher can then check to determine which unit or units have tripped out, when they may be reclosed in the usual manner by the operation of the control key.

Motors for Gaseous Mines

Direct-current motors with starting switches, designed to meet the requirements of the U. S. Bureau of Mines for equipment permissible for use in gaseous mines, have been developed by the General Electric Company and are offered in 1, 3 and 5-hp. ratings. These equipments are for use on mine pumps, room conveyors and for similar applications where constant-speed, direct-current motors are suitable. These motors and starters, when included in an assembly of elements submitted for approval to the Bureau of Mines, will not themselves need to be tested in an explosive mixture, since they have already met the requirements of such test; but the approval plate can be applied only when the whole assembly has been approved, which is in accordance with the bureau's established practice. The new equipment has been give the General Electric designation "Class BM."

Across-the-Line Motor

A line of squirrel cage motors from 1 hp. to 30 hp. for control by an automatic push-button system has been developed by the Triumph Electric Corporation, Cincinnati. These motors are designed to develop at least 150 per cent of the full-load torque at starting, when connected directly across the line. There is no compensator or resistance type starter used, and the current taken is below the limits set by the N.E.L.A. regulations. The motors are fitted with Timken roller bearings, but can be supplied with either ball or sleeve bearings if desired.

PRIMARY CUTOUTS.—A new line of inclosed expulsion type cutouts has been designed by the General Electric Company. The new cutouts are said to have very high dielectric strength, both for 60-cycle and impulse voltages. Current ratings and interrupting capacity ratings have been increased over those of previous designs. The line comprises four cutouts, rated as follows: 60 amp., 2,500/4,000Y volts; 60 amp., 7,500 volts; 150 amp., 5,000 volts, and 150 amp., 7,500/12,500Y volts. The company states that the 60-amp. cutout can economically replace plug type cutouts generally used on 2,300/4,000Y volt systems. The wet-process porcelain housings used are of a new design. The doors are of "Textolite," a molded insulating compound, with handles of the same material, and they may be opened by a pull of a standard switch hook. The fuse holder is supported by the door and is removed from the circuit when the door is opened.

Electrical Patents

Announced by U. S. Patent Office

(Issued April 3, 1928)

Reissue 16,920. BURGLAR-PROOF INDUCTION COIL; H. J. Murray, New York, N. Y. App. filed Oct. 11, 1921.

1,664,403. CIRCUIT-CONTINUING DEVICE; H. A. Douglas, Bronson, Mich. App. filed April 17, 1922. For a headlighting or other reflecting lamp.

1,664,408. ATTACHMENT PLUG; F. F. Frakes, Columbia, Tenn. App. filed May 31, 1927. Having a fuse of the removable type in circuit with the plug, and secured therein.

1,664,429. ELECTRIC PAINT REMOVER; W. Multhaup, Winona, Minn. App. filed March 29, 1927.

1,664,457. ELECTRICAL HAIR OR MASSAGE BRUSH; A. Lloyd, London, England. App. filed April 10, 1926.

1,664,519. AUTOMATIC REGULATION IN ELECTRIC-LIGHTING SYSTEMS; F. C. Lyne, Westminster, London, and J. Etchells, Aston, Birmingham, England. App. filed April 25, 1927. As train lighting systems.

1,664,534. CIRCUIT CONTROLLER; F. D. Zimmerman and E. M. Pyle, Jerome, Pa. App. filed May 26, 1926. Manually operable electric motor starters and controllers.

1,664,540. DYNAMO FRAME; W. A. Chryst, Dayton, Ohio. App. filed Aug. 27, 1925. For small machines as are used on automobiles.

1,664,561. SHORT-CIRCUITING MECHANISM; J. J. Janca, St. Louis, Mo. App. filed Dec. 24, 1925. For single phase motors.

1,664,584. ELECTRIC COOKING AND HEATING APPARATUS; J. H. Williams, Toronto, Ont., Can. App. filed April 6, 1925. For use in apartments or rooms where the usual cooking and heating facilities are not readily available; fireless cooker type.

1,664,586. SWITCHING APPARATUS; L. T. Barnes, Hempstead, N. Y. App. filed Dec. 5, 1925. Applicable to flashing lamps or the like.

1,664,624. ELECTRIC-FIXTURE MOUNT; M. Heichen, Brooklyn, N. Y. App. filed July 24, 1926. Combined switch and mounting for side wall fixtures.

1,664,672, 1,664,673. INDUCTION ELECTRICITY METER. A. L. Emens, Lafayette, Ind. Apps. filed March 12 and Dec. 24, 1926. Having a protecting outer case.

1,664,686. JUNCTION FITTING FOR METALLIC ARMORED ELECTRICAL CONDUCTORS; J. H. Hunter, Detroit, Mich. App. filed April 13, 1925.

1,664,692. COUPLING FOR BATTERY TERMINALS; F. W. Leuthesser, Oak Park, Ill. App. filed March 7, 1925.

1,664,708. BRUSH FOR GENERATORS, ETC.; A. A. Schupp, Saginaw, Mich. App. filed April 2, 1924. Made of a cast metal alloy consisting of metallic lead and metallic copper in substantially equal proportions.

1,664,720. THERMO ELECTRIC GENERATOR; C. W. Woodruff, Columbus, Ohio. App. filed Dec. 7, 1925. Thermo-electric cell of the type employing hot and cold junctions of dissimilar metals for supplying filament and plate currents in vacuum tube circuits.

1,664,750. PROCESS FOR THE PRODUCTION OF GALVANIC METAL COATINGS; F. Kirschner, Vienna, Austria. App. filed Oct. 12, 1923.

1,664,758. ELECTRICALLY HEATED SADIRON STAND; R. O. Reynolds, Auburn, Me. App. filed Nov. 26, 1926.

1,664,759. ELECTRIC FITTING AND THE LIKE; A. B. Rypinski, Brooklyn, N. Y. App. filed May 13, 1921. Mountings of sockets on a base of porcelain or non-conducting material.

1,664,778. THERMOSTAT; L. P. Hynes, Albany, N. Y. App. filed March 24, 1923. As used on railway cars to control the heating.

1,664,781. DYNAMO-ELECTRIC MACHINE; G. H. Leland, Dayton, Ohio. App. filed Nov. 22, 1920. Single-phase alternating current motors of the repulsion-starting and induction-running type.

1,664,800. ELECTROCHEMICAL METHOD OF AND MEANS FOR PROTECTING BURIED PIPE LINES AGAINST CORROSION; R. Van A. Mills, Sandy Spring, Md. App. filed Dec. 5, 1924.

1,664,845. SWITCHING DEVICE; A. P. Ball, Detroit, Mich. App. filed Nov. 23, 1921. Having means which insure that the movable switch contacts will be completely engaged with the stationary contacts upon a closing movement of a switch operating handle or analagous device.

1,664,857. CIGARETTE LIGHTER; M. J. Harkless, Homewood, Ill. App. filed Sept. 13, 1926.

1,664,882. METAL-CASTING MACHINE; W. S. Hadaway, Jr., New Rochelle, N. Y. App. filed Sept. 6, 1921. Heaters for metal molding machines, such as those used for casting type.

1,664,947. TRAFFIC REGULATOR; M. E. Rusch, St. Paul, Minn. App. filed Nov. 13, 1925.

1,664,952. SIGNALING APPARATUS; N. H. Suren, Needham, Mass. App. filed Sept. 6, 1924. Non-interference signal transmitter for use in signaling systems which are normally conditioned for metallic circuit operation and have provision for operation through a normally open ground return in the event of a broken metallic circuit.

1,664,986. PLUG CONNECTER; B. P. McKinley, Flushing, N. Y. App. filed Dec. 8, 1923. Twin type.

1,664,992. ELECTROTHERAPEUTICAL APPARATUS; S. Pongo, New York, N. Y. App. filed July 26, 1927. Electric bath-cabinet.

1,665,014. THERMOSTATIC CURRENT CONTROL; O. Q. Beckworth, Los Angeles, Calif. App. filed July 9, 1925.

1,665,018. ELECTRIC SWIVEL SOCKET; P. S. Black, Fort Worth, Tex. App. filed April 25, 1927.

1,665,021. AUTOMATIC ELECTRIC SWITCH FOR CABLE-CARRYING DRUMS; J. H. Cohen, Bridgeport, Conn. App. filed Nov. 3, 1923.

1,665,038. ELECTRIC WELDING MACHINE; J. W. Meadowcroft, Philadelphia, Pa. App. filed Dec. 7, 1925. Spot welder with work-handling mechanism adapted for use where the parts or assemblies to be welded are relatively large and cumbersome, such as the door and body sills in the building of sheet steel automobile bodies.

1,665,048. BATTERY TERMINAL; A. W. Weimer and J. F. Smith, Geneseo, Ill. App. filed Jan. 3, 1927.

1,665,060. AUTOMATIC CONTROL MEANS FOR ELECTROMAGNETIC OPERATING DEVICES; H. K. Hitchcock, Pittsburgh, Pa. App. filed Feb. 5, 1927.

1,665,062. MOLD FOR MAKING METAL PATTERNS BY ELECTRODEPOSITION; A. K. Laukel, Detroit, Mich. App. filed Oct. 15, 1926.

1,665,066, 1,665,067. ELECTRIC WELDING MACHINE; J. W. Meadowcroft, Philadelphia, Pa. Apps. filed Nov. 24, 1925 and March 7, 1927. For spot welding.

1,665,095. EECTRICAL PLUG LOCK; J. B. Henry, Connersville, Ind. App. filed Jan. 5, 1927.

1,665,113. CIRCUIT BREAKER; F. W. Roller, East Orange, N. J. App. filed Sept. 24, 1924. Automatic air circuit breaker.

1,665,122. TRACTOR-LIGHTING DEVICE; W. H. White, Copeland, Kan. App. filed June 25, 1927. Means for attaching a magneto to tractor so that it will be driven from the pulley shaft of the tractor to furnish current for a lighting system placed on the tractor.

1,665,126. SAFETY SWITCHBOARD; J. F. Burns, Philadelphia, Pa. App. filed June 23, 1922.

1,665,166. ELECTRICAL CONNECTER; J. E. Graham, London, England. App. filed Oct. 21, 1925.

1,665,169. HOLDER FOR ELECTRIC FUSES; O. E. Holtsclaw, Elwood, Ind. App. filed April 21, 1925. To hold a fuse perfectly tight without the aid of springs.

1,665,191. HIGH-TENSION CABLE TO PREVENT A BREAKING DOWN OF THE INSULATION; E. G. Sievert and H. Svenson, Sundbyberg, near Stockholm, Sweden. App. filed Nov. 9, 1925.

New Trade Literature

ASBESTOS INSULATED WIRES AND CABLES.—The Rockbestos Products Corporation, New Haven, Conn., has issued two bulletins covering the Rockbestos "A.V.C." (asbestos and varnished cambric) cables. The bulletins give complete construction specification tables for this insulation, which is intended for the utmost in severe conditions of heat, moisture, acid fumes, oil, flame and gas. Another bulletin issued by the company contains the standard specification of all Rockbestos insulated wires and cables as to the quality of the copper, the asbestos and the method of impregnating, testing and inspecting. A new asbestos and varnished cambric insulated switchboard wire is described in the bulletin covering switchboard wires and cables.

TRANSFORMERS.—The Packard Electric Company, Warren, Ohio, has issued pamphlets Nos. 529, 521 and 517 describing and illustrating its type LD dry-type current transformers, type BK1, BK2 and BK3 indoor dry-type current transformers and its type PW outdoor potential transformers.

TRANSMISSION AND DISTRIBUTION MATERIAL.—Porter & Ross, Inc., 30 Church Street, New York City, has issued a 240-page illustrated catalog as a source of pole line material buying information. The catalog contains a good deal of material covering poles and includes specifications, information for storing and painting poles, and a table of sizes and carloadings. A chapter is devoted to outdoor substation equipment covering a line of disconnecting switches, bus supports, straight connectors, etc. A line of construction tools are also described and illustrated.

ELECTRICAL AIR HEATERS.—A catalog issued by the Edison Electric Appliance Company, Inc., 5600 West Taylor Street, Chicago, describes the "Hotpoint" electric air heaters for the home. The catalog is well illustrated and a chapter is devoted to the essentials of correct room heating. The "Calrod" heating unit used in "Hotpoint" heaters is illustrated and described. The catalog contains information as to how to determine heater sizes, how to estimate heating costs, and other miscellaneous data on heating.

AIR PREHEATER.—Catalog AH-3 issued by the Combustion Engineering Corporation, 200 Madison Avenue, New York City, describes and illustrates the "C-E" air preheater. It contains charts showing typical performances of the air preheater and drawings show the applications of the air preheater to different installations.

MOTOR-GENERATOR SETS.—Bulletin No. 450 issued by Roth Brothers & Company, 1400 West Adams Street, Chicago, describes and illustrates its motor-generator sets, including the new two-bearing motor-generator sets recently developed by the company. General specifications covering the line are included. Tables give a complete listing of the various sizes in the different lines.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Rosario, Argentina (No. 30,667), for storage and radio batteries.

Purchase is desired in Temuco, Chile (No. 30,665), of batteries and flash lights.

Purchase is desired in Baghdad, Iraq (No. 30,696), of electric automobile bulbs.

Purchase is desired in Durango, Mexico (Nos. 30,674 and 30,675), of electric corn poppers and electric ice cream freezing machines.

An agency is desired in Manila, P. I. (No. 30,669), for electrical goods.

An agency is desired in Rome, Italy (No. 30,668), for household electrical machines, especially refrigerators and washing machines.

An agency is desired in Warsaw, Poland (No. 30,666), for farm lighting plants.

An agency is desired in Paris, France (No. 30,643), for air compressors.

Purchase is desired in Naples, Italy (No. 30,641), of hand-operated floor-scraping (parquet) machines.

Remarkable building progress has been made in the principal South African municipalities and many projects are contemplated.

A power company has filed plans with the Canadian Department of Public Works at Ottawa for a hydro-electric development on the Ottawa River, to cost $2,500,000. The property now held by the company is in virtue of a water lease from the Province of Quebec. (Canada No. 274,191.)

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

The Assistant Tax Collector

OF EVERY dollar paid by the public for electric light and power, 10 cents is used for taxes. The electric service company is one of the assistant tax collectors, and a big one, for our various political subdivisions.

The percentage of the public's dollar which it has to pass on differs among the several states, ranging, among the states for which information is available, from 6.7 per cent in Alabama to 13.5 per cent in South Carolina. The average rate is about 9.7 per cent.

On the basis of data taken from public utility commission reports or obtained at commission offices it has been possible to analyze the operations in twenty states and the District of Columbia. Although this is fewer than half the number, the operations account for $1,026,163,241 of the operating revenue for 1926, constituting about 62 per cent of the national total. The taxes paid by the companies earning this revenue amounted to almost $100,000,000, or, to be precise, $99,303,840. Assuming that the same ratio holds in the remaining states, the electric light and power companies of the United States paid, in 1926, about $160,000,000 in taxes.

Data were also obtained for one additional state, Kansas, but they unfortunately did not include operations of companies serving only one city or town each. To what extent that omission may affect the ratios is not known, but it is not believed to be great. The state figures as reported indicate a tax ratio of about 5 per cent, which is lower than that for Alabama and is, in fact, the lowest figure received. If this truly represents the situation it is then proper to include the Kansas figures with the others; the effect is to change the general average to 9.6 per cent. The effect on the estimated national total of $160,000,000 for taxes is negligible.

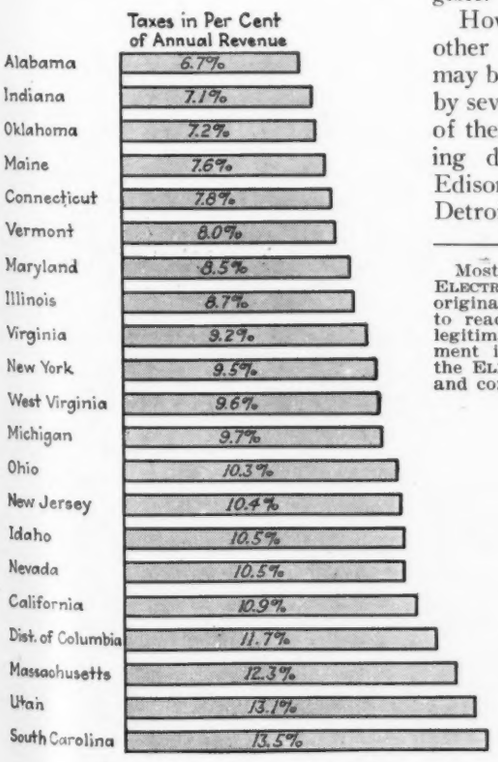
How this sum compares with the other expenditures of the industry may be judged from figures published by several individual companies. Two of them are shown in the accompanying diagram: The Commonwealth Edison Company for 1925 and the Detroit Edison Company for 1926. Their proportion for taxes corresponds fairly well with the national average, and the allocation of costs may be regarded as typical. It will be seen that the taxes are roughly equal to the interest charges on the funded debt; they are from half to two-thirds as great as the cost of fuel; they are about half as large as the biggest item, that for labor.

Attempts to draw deductions regarding localities or types of plant associated with high or low tax ratios lead to inconclusive results. Alabama and South Carolina are both Southern states. One is at the top of the column, the other at the bottom. In New England Maine, Connecticut and Vermont are near one end of the list and Massachusetts near the other. Waterpower states like Alabama, Maine and California are not distinguishable, by position in the table, from predominantly fuel-using states like Indiana, Oklahoma, New Jersey or Massachusetts.

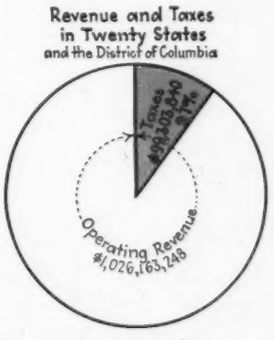
The circumstance that taxation is usually based primarily on property values rather than on revenue is of especial significance to electric power companies, where, in round numbers, an investment of five dollars is required to bring in a dollar of revenue. The effect is to make the ratio of taxes to earnings much higher than in industries or other business activities having a more rapid turn-over.

Electric service carries a very sizable indirect tax. This expense becomes part of the production cost. It cannot be taken out of any of the other items.

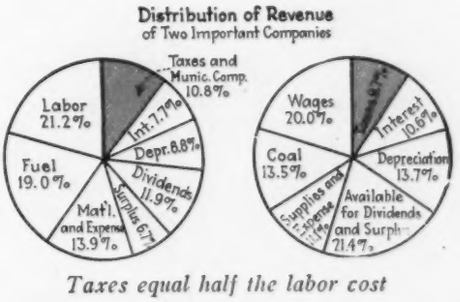
Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers to quote or use them for any legitimate purpose. While no acknowledgment is required, users will, by crediting the ELECTRICAL WORLD, help it in obtaining and compiling further basic information.



One dollar in seven for taxes



Taxes absorbed 9.7 per cent



Taxes equal half the labor cost

West Reports Increased Activity During First Quarter

THAT the manufacturing plants of the Western States witnessed slightly increased productivity during the first quarter over that reported for the same period in 1927 is indicated by reports received on monthly electrical energy consumption by some 400 large manufacturing plants operating in this section. The increased average rate of productivity during the quarter was 2.2 per cent over the first quarter of last year. The year opened with the rate of activity slightly under that of January last year, but both February and March witnessed a rate of activity over that of the same months last year, the March activity being about 10.4 per cent over March of 1927, but slightly below March of 1926. Past history indicated that a drop in the rate of activity in manufacturing plants was normally to be expected in March, and the current March followed this general trend by reporting a drop of 5.3 per cent under February. This was slightly under the drop witnessed by general industry in the nation as a whole.

Every industrial group operating in the Western States reported a rate of operations during March under that of February, after correction is made for the number of working days. On the other hand, every industrial group, except the metal industries group and the shipbuilding industry, reported March operations over those of March last year. Three of the industrial group—chemicals and allied products, metal industries group and shipbuilding—reported an average rate of operations during the first quarter of the current year under that of the same period last year.

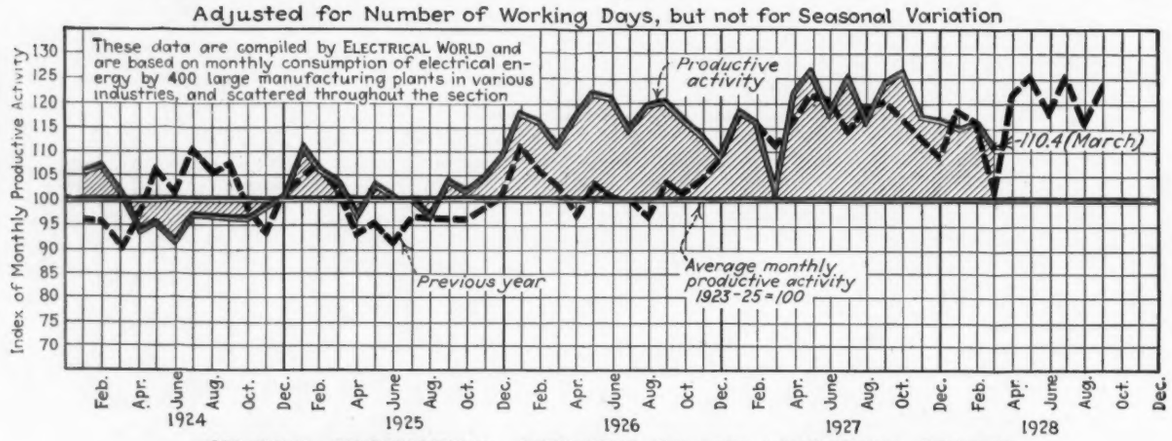
Indexes of Productive Activity in the Western States

All Figures Adjusted for Number of Working Days

	March, 1928	February, 1928	March, 1927	Average for First Quarter 1928	Average for First Quarter 1927
All industry	110.4	116.7	100.1	114.0	111.6
Chemicals and allied products	104.6	106.9	85.8	104.8	109.5
Food and kindred products	101.8	104.8	83.8	106.8	92.5
Lumber and its products	122.0	124.2	91.1	121.8	105.3
Metal industries group	113.3	123.0	130.7	123.4	136.8
Paper and pulp	131.2	139.7	118.7	135.7	129.5
Rubber	153.6	159.8	.....	151.2	.....
Shipbuilding	84.7	100.5	117.7	93.8	123.5
Stone, clay and glass	139.4	170.8	.....	153.4	.....

ELECTRICAL WORLD *Barometer of Industrial Activity in the Western States*

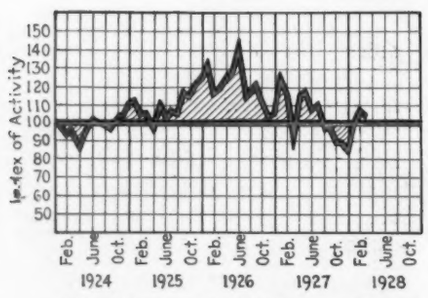
Adjusted for Number of Working Days, but not for Seasonal Variation


These data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 400 large manufacturing plants in various industries, and scattered throughout the section
Index of Monthly Productive Activity
Productive activity
110.4 (March)
Previous year
Average monthly productive activity 1923-25=100
1924
1925
1926
1927
1928

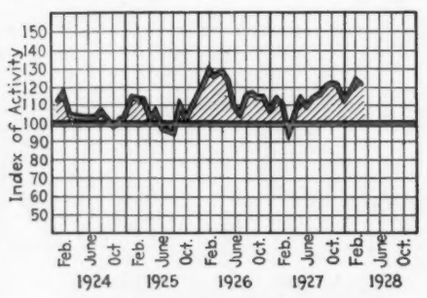
States in the WESTERN GROUP

Montana, Idaho, Wyoming, Colorado, New Mexico, Utah, Nevada, Washington, Oregon, California.

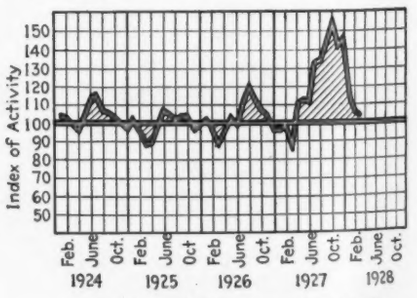
GENERAL PRODUCTIVE ACTIVITY IN THE WESTERN STATES



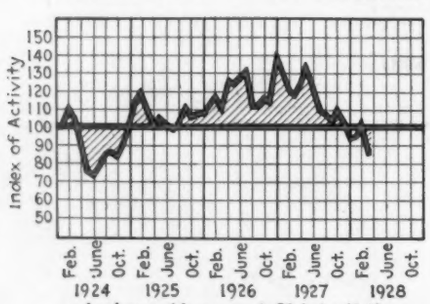
Chemical and Allied Products



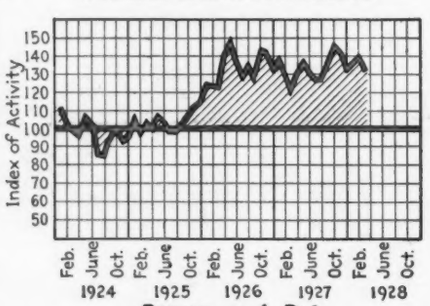
Lumber and Its Products



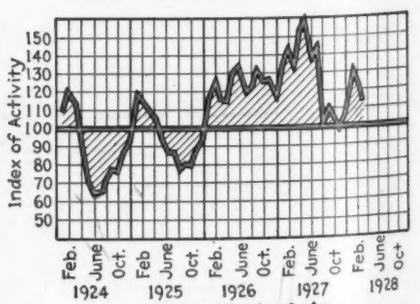
Food and Kindred Products



Automotive and Shipbuilding



Paper and Pulp



Metal Industries

PRODUCTIVE ACTIVITY IN THE PRIMARY INDUSTRIES OF THE WESTERN STATES